

Aviation Week & Space Technology

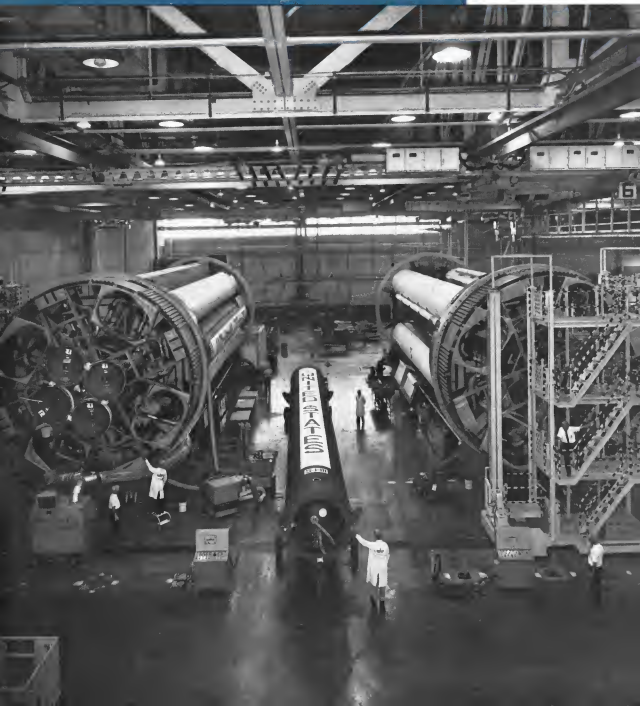
September 16, 1963

Weight of S-1
Trimmed to Aid
Apollo Mission

First Chrysler S-1
Boosters at Michoud

70 Cents

A McGraw-Hill Publication

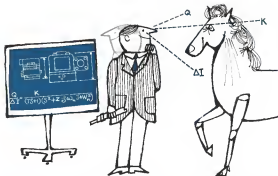


You can take your work to the
HONEYWELL 8100 TAPE RECORDER

or
you can
take
the
8100
to
your
work!

Completely portable, completely self-contained, the new Honeywell 8100 recorder/reproducer offers instrumentation quality in a package you can carry from tool to tool with one hand. Or you can rack-mount the 8100, as shown at left with a Honeywell Model 150B Visucorder Oscillograph. The 8100 contains all its own electronics, plus such convenience features as a built-in calibration panel and automatic switching of carrier frequencies. You can record analog data from DC to 10,000 cps on up to 8 data channels. And there's an optional baseline scope for monitoring data while you record. Available with either 1/2 or 1/4 inch tape. Weight only 40 pounds. Price from \$9800 to \$11,500. Write for brochure #7338 to Honeywell, Denver Division, Denver 10, Colorado.

Honeywell



HOW TO PICK A WINNER! SERVOVALVES OR HORSES

With the eye and a stopwatch. It takes both to pick the distinguished who's a stables winner. Now, let's see what it takes to handicap the winners as servovalves. Popularity between performance and cost. That's the way to pick a servovalve. Vickers lets you select a servovalve rated exactly to your application. Because you can choose from both jet pipe and flapper nozzle servovalves, your selection can contain high response characteristics and outstanding tolerance to suit your needs precisely.

Remember that reliability is basic. It's vital to deal with a manufacturer who not only makes a claim, but who can back it up.

High temperature operation, maximum weight and envelope, low input power and compatibility with a wide variety of fluids are among other benefits you'll find combined in Vickers servovalves. Another factor worth considering—Vickers has proved its ability to deliver production quantities to specifications.

Let us help you make a trade off study that is bound to provide you with the exact combination of performance characteristics you need... and at a cost that fits your present requirements. Write us at it, with for Servovalve Bulletin A-5281 and for Vickers Servovalve Terms and Definitions Handbook. Write to: Vickers Incorporated, P. O. Box 302, Troy, Michigan.



Two basic Vickers servovalve designs. Illustrated the subminiature jet-pipe servovalve (left) and the outstandingly robust jet nozzle (right).

VICKERS
DIVISION OF SPERRY RAND CORPORATION



This Target Intercept Computer controls the Nike-Zeus anti-missiles launched from Kwajalein Island

Quick! What company makes it?

The men at the United States Army Materiel Command can tell you: UNIVAC.

They can tell you because of the ICBM-bested targets that the Nike-Zeus missiles have intercepted so successfully. How is it done? The Target Intercept Computer designed and built by UNIVAC for Bell Telephone Laboratories, predicts an intercept point, based on the constant updating of the ICBM's current speed and position in space. It initiates the launch order for the Nike-Zeus, issues steering orders to keep Zeus on an intercept trajectory, instructs Zeus at the precise time to "burst" and "destroy" the target and then calculates intercept accuracy data since neither missile carries a live warhead in this test program. And because both missiles travel at such great speeds, the UNIVAC Target Intercept Computer is required to perform at least 165,000 computations per second.

UNIVAC has been part of the Nike-

Zeus Program since its inception. The profound experience in ballistic-missile defense systems is today concentrated on the design and development of guidance and control functions for the recently authorized Nike-X anti-missile missile system now under development.

Unusual? Uncommon? Not if you know UNIVAC.

From the yesterday of ENIAC and BINAC, to the fluid mechanics, microelectronic circuitry and thin film magnetic memories of today, UNIVAC has made most of the industry's major technical advances. UNIVAC offers a quick response to every demand... outstanding scientific and engineering talent... total systems programming and management capability. Can this demonstrated competence work for you?

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Ready for advancement? You'll be better off with the company that has never stopped making advances. Contact: An Equal Opportunity Employer.

AEROSPACE CALENDAR

- Sept. 13-15**—13th Annual Meeting, Solid Ion Engineers Society, Sheraton Hotel, Washington, D.C.
- Sept. 13-15**—Symposium on Scientific and Dynamic Modeling Technology, Sikorsky Helicopters Division, Ohio, sponsored by Ford Systems Command's Symposium on Science, Dayton, Ohio.
- Sept. 17-21**—National Automatic and Space Engineering and Manufacturing Meeting and Display Society of Automatic Engineers, Ambassador Hotel, Los Angeles.
- Sept. 21-27**—International Telecommunications Conference, Savoy Place, London, England.
- Sept. 21-27**—International Conference on Space, American Institute of Aeronautics and Astronautics Institute of Electrical and Electronic Engineers International Society of America.
- Sept. 14-15**—18th Annual Convention and Aircraft Show, National Business Aircraft Association, Rye Brook, New York.
- Sept. 21-25**—25th National Annual Symposium on the Physics of Fluids in Electronics, Chicago, Illinois, sponsored by the American Physical Society, American Research Foundation.
- Sept. 25-26**—Seminar and Exhibit, Aerospace Asia for Construction, Conrad Sheraton Hotel, Miami, Florida.
- Sept. 25-26**—1-18th Congress, International Astronautical Federation, Paris.
- Sept. 27-28**—Security of Spacecraft, First White Sands Annual Report to the (Continued on page 7)

AVIATION WEEK & Space Technology

September 14, 1962
Vol. 79, No. 12

The first system has been delivered to NASA's Quality Assurance Division at Marshall Space Flight Center, Huntsville, Alabama.

The system consists of a Control Computer Complex, comprising a Master Control Console and multiple PE-250 Computers in a master-slave relationship, and includes an antenna unit having the capability of automatic precision and response measurements of a functional system of the space vehicle and its ground support equipment.

"As the Master Console a Friden Flexowriter provides direct connection to any computer in the Complex. The Flexowriter is used for the normal paper tape and typewriter data communications with any PE-250 as it is used as an off-line computer.

"The majority of special communications with the system are provided by Flexowriters located at each test station and by an additional (off-board) Flexowriter located in the Master Control Console. These Flexowriters are an integral part of the automatic data-linkage necessary for the successful operation of a complete automated system.

"The Satellite Test Station Flexowriters and the Inboard Flexowriter at the Master Console participate in all three modes of operation of the Automatic Checkout System.

Flexowriter, a brand name registered by the International Business Machines Corporation, is a trademark of International Business Machines Corporation. The name is used herein under license.

Flexowriter, a brand name registered by the International Business Machines Corporation, is a trademark of International Business Machines Corporation. The name is used herein under license.

Packard Bell Electronics' Saturn Automatic Checkout System

How the Friden Flexowriter® controls its man-machine communications



By Jerry Slazman, Member Electronics Division, Saturn System, SATURN System, Packard Bell Electronics, Los Angeles, California

"The SATURN Automatic Checkout System built by Packard Bell Electronics is a computer-controlled system used for heavy checkout of the SATURN booster. The first system has been delivered to NASA's Quality Assurance Division at Marshall Space Flight Center, Huntsville, Alabama.

The system consists of a Control Computer Complex, comprising a Master Control Console and multiple PE-250 Computers in a master-slave relationship, and includes an antenna unit having the capability of automatic precision and response measurements of a functional system of the space vehicle and its ground support equipment.

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Flexowriter, a brand name registered by the International Business Machines Corporation, is a trademark of International Business Machines Corporation. The name is used herein under license.

"In the automatic mode, under computer control, the Flexowriters provide each stage in test tape output of test results, indications of GO and NO GO measurements with these indications points type out of test progress and type out of the normal test tape being executed, and type out of test tape of operator interventions where manual intervention is required.

"In the manual mode the test stations are all line from the computer complex, and the Flexowriter is used as the means of command communication with the test station. They provide details for manual data entry via the keyboard or the Flexowriter Tape Reader, and allow such operations as manually tape changing through a program loading, continuous cycling for automatic processing, and the manual securing of various system devices for confidence check of hardware and programming.

"In the single tape mode, the Flexowriter and its associated loading of master programs or hardware by allowing manual data entry via the keyboard with the single tape supporting provided by the test station.

"In addition to their function as integral test station devices, master are provided for easily entering the Flexowriter as an off-line operation for the more conventional tasks such as operating program tapes, and reprogramming existing tapes."



The versatility of the Flexowriter as an input/output medium, a data reader and data writer, make it an indispensable in the design and operation of any computer system. It fully complements the Flexowriter's versatility with your local Friden System even on wide: Friden Inc., San Leandro, California.

And should you need to know the Flexowriter in an application you would like to share with your fellow engineers in their papers, just write and tell us about it. Address: Mr. George Boyles, Friden Inc., San Leandro, California.

John Boyles and Associates throughout the World.

Friden



Instant Bookmark

The technology of information retrieval is one of the major concerns of SDC. For some time, our Sabin system (a state-of-the-art, automatic information retrieval) has been capable of quickly pinpointing, at widely separated SDC facilities, desired technical documents and authors' names. Sabin can be operated by remote control, the only such system that can be so operated. A still newer SDC development in Proteomorph II, which is a phase of Sabin, our long range project to teach computers to read and write English. Proteomorph is now able, almost casually, to find simple passages within the complex text of an article or document. Next will come the ability to extract (highlight) sentences and facts. As SDC continues to make telemetry progress in many areas of information-system technology, a number of new

positions have been created on several of these major projects. Research fellows, systems research scientists, systems-oriented engineers, and computer programmers interested in joining this rapidly expanding technology are invited to write Mr. A. J. Greenleaf, Jr., SDC, 2430 Colorado Avenue, Santa Monica, California. Positions are open at SDC facilities at Santa Monica, Washington, D.C.; Lexington, Massachusetts; Princeton, New Jersey; and Dayton, Ohio. As SDC broadens an information retrieval site is available. Requests for this new brochure should be sent to Mr. Greenleaf at Santa Monica. "An equal opportunity employer."

System Development Corporation



AEROSPACE CALENDAR

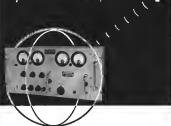
(Continued from page 5)

- Astronaut Professor and Astronaut Benquet, Beverly Hills Hotel, Beverly Hills
- Sept. 18-Oct. 1-Manned Interplanetary Exploration Meeting, American Institute of Aeronautics and Astronautics, Columbia House Hotel, Palo Alto, Calif.
- Sept. 18-Oct. 1-Casualties of War Conference, Joint of Electrical and Electronic Engineers, Edinburgh Park, Scotland
- Oct. 12-Project Mercury Summary Conference, NASA, Manned Spacecraft Center, Houston, Tex. (by invitation)
- Oct. 13-English National Symposium on Space Electronics, Institute of Electrical and Electronics Engineers, Pasadena Hotel, Miami Beach, Fla.
- Oct. 15-Manned Aerospace Nuclear Safety Topical Meeting, American Nuclear Society, Albuquerque, N. M. Cosponsored: Los Alamos Scientific Laboratory, AEC Aerospace Operations Office, AF Special Weapons Center, AF Directorate of Nuclear Safety, Sandoz Corp., University of New Mexico
- Oct. 15-Symposium on Physics and New Structures, Starting (unpublished), San Antonio, Tex. Sponsored by Southwest Research Institute
- Oct. 14-First National Aerospace Nuclear Safety Topical Meeting, American Nuclear Society, Albuquerque, N. M.
- Oct. 24-National Assn. of Air Traffic Specialists, Sheraton-Orchard Hotel, Oklahoma City, Okla.
- Oct. 25B-1966 International Astronautical Congress, Cosmos International, Sao Paulo, Italy
- Oct. 26-Second Annual USAF Contract Acceptor Review Symposium, Dayton Defense, Dayton, Ohio. Spacewar National Symposium, Santa Ana
- Oct. 29-North National Communications Symposium, Institute of Electrical and Electronics Engineers, Hotel Utah, Utah
- Oct. 31-International Air Transport Association, Annual General Meeting, Rome, Italy
- Oct. 31-William Tell 1963, USAF International Weapons Meet, Travis AFB, Calif. Air Defense Command
- Oct. 31B-1966 Annual Air Force Science and Engineering Symposium, Air Force Scientific College, Summer Office of Aerospace Research, AFPC
- Oct. 31B-National August Conference, Kansas, Okla. Sponsored: American Assn. of Airport Executives & Directors of Oklahoma with the cooperation of FAA
- Oct. 31B-International Conference on Electromagnetic Interference, University, Austin, Texas
- Oct. 31B-1966 Annual Aerospace Electronics Symposium, Conference, Aerospace Electrical Society, San Paulo Auditorium, Los Angeles, Calif.
- Oct. 31B-1966 International Symposium on Space, Aerospace, and Defense, Conference, Lafayette Hotel, Long Beach, Calif. Sponsored: Professional Engineers in Dallas
- Oct. 31B-1966 Casual Conference, Field Conference, American Institute of Aeronautics and Astronautics, Miami City
- Oct. 31B-1966 Annual Meeting and Conference, Aerospace Electrical Society, Conference, Sheraton Hotel, New Orleans, La. (Continued on page 9)

NOW from DEI

High Performance...Very Low Noise...
Modular

VHF/UHF Satellite Telemetry Receiver



- Crystal controlled RF heads from 50 MC to 1000 MC
- IF bandwidths from 10 KC to 500 KC
- FM, AM, Phase-lock and Phase demodulators
- Plug-in pre-detection recording converters

Already used in more than a dozen unmanned earth orbit satellite programs, the Model TMR-6 telemetry receiver from Defense Electronics, Inc. has no true equivalent in its field.

The completely modular unit has been specially designed by DEI to accept inexpensive plug-in sub-assemblies... seven RF tuning heads, one IF amplifier and four demodulators... to cover all presently assigned frequencies in the VHF/UHF spectrum.

The TMR-6 features crystal control of both oscillator, extremely low noise figures and can be adapted for use in FM systems by means of a phase-locked loop around the mixer receiver. It is capable of tracking any frequency change introduced by Doppler shift, acceleration and reception modulators up to 0.002 per cent of the received frequency.

This versatile, low-cost receiver also accepts plug-in modules for pre-detection recording of either AM or FM with existing stationary head video tape recorder.

For real time data recovery at its final, write for DEI bulletin TMR-6 or call:



DEFENSE
ELECTRONICS
AND INSTRUMENTS

Defense Electronics, Inc.
Rockville, Maryland

TELE: 301-494-4700 FAX: 301-494-2630
Bompa Oaks, California, Branch: 803-4332

FUEL CONTAINMENT

The Hawker Siddeley Dynamics aircraft fuel control is based on the GRIE concept automatically controls and protects the engine irrespective of power demands. It features automatic temperature-controlled starting and automatically terminating start as selected start speed. This most advanced system is applied to all types of gas turbine engines.



AIR CONDITIONING

Hawker Siddeley Dynamics design and manufacture complete air conditioning systems which are fully tested in the most severe operating conditions in a climate before delivery. Components can be supplied to meet individual requirements.



POWER SUPPLY

A range of power systems to meet requirements of 400/230/115 has been designed and developed and is being supplied for both civil and military aircraft. Power outputs from 100 VA to 2500 VA.



AUTOMATIC CHECKOUT

Rapid engine testing and fault location of systems is essential for the quick turn round of the engine for a modern aircraft. Hawker Siddeley Dynamics automatic test equipment has been developed and designed to meet this need and can perform up to 1,000 tests per hour in an interval of 0.1 s on aircraft systems. This leads to greater economy, reliability and safety.



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Head Office: Reading, Berkshire, England

AEROSPACE CALENDAR

(Continued from page 7)

Oct. 14-16—Eighteenth Annual Exposition and Symposium, Air Traffic Control Assn., Sheraton Hotel, Dallas, Tex.

Oct. 14-15—Eighteenth Symposium on Ballistic Missile and Space Technology, Naval Training Center, San Diego, Calif. (open to 12 Space Systems Div., AF Institute Systems Div., Aerospace Corp.)

Oct. 16—Second Annual National Colloquium Society of American Value Engineers, Airport-Mexico Hotel, Los Angeles, Calif.

Oct. 16-18—Tenth National Vacuum Symposium, American Vacuum Society, Statler Hilton Hotel, Boston, Mass.

Oct. 17—Fourth Annual One Day Technical Symposium on Information Processing in the Modern Capital University of Maryland, College Park, Md.

Oct. 17-18, Oct. 18-22—North Atlantic American Conference, American Institute of Aeronautics and Space Institute Royal Aeronautical Society, Monographs Institute of Technology, Kensington, Mass. (Oct. 17-18) Queen Elizabeth Hotel, Montreal, Canada (Oct. 18-22)

Oct. 21-25—Bank Annual Red Cross Conference on Aerospace and Nonaerospace Electronics, Institute of Electrical and Electronics Engineers, Taormina Hotel, Taormina, Md.

Oct. 21-23—Annual Meeting, Assn. of the U.S. Army, Shannon Park Hotel, Washington, D.C.

Oct. 21-23—Third National Convention, Society for Nondestructive Testing, Pullman Hotel, Cleveland, Ohio.

Oct. 25-28—13th Annual Aerospace, Fluid Power Conference, Sheraton Hotel, Detroit, Mich. (Space Aerospace Div. of Vickers Inc.)

Oct. 25-28—Fall Meeting, Western States Section, The Combustion Institute, University of Southern California, Los Angeles, Calif.

Oct. 28-30—National Electronics Conference, McCormack Place, Chicago, Ill.

Oct. 30-Nov. 1—Annual Convention Southwestern Airport Manager Assn., Kansas Hotel, Kansas City, Mo.

Oct. 30-Nov. 1-1961, Electronic Device Meeting, Institute of Electrical and Electronics Engineers, Sheraton Hotel, Washington, D.C.

Oct. 30-Nov. 1—Fall Quaker Regional Meeting Assn. of Local Transporters Inc., Royal Britannia Hotel, Honolulu, Hawaii.

Nov. 1-3—International Air Safety Seminar, Flight Safety Foundation, Atlantic Glenside, Tex. (150 members and by invitation)

Nov. 4-6—Vehicle Design and Propulsion Meeting, American Institute of Aeronautics and Astronautics, Air Force Station, Cleveland, Wright-Patterson AFB, Dayton, Ohio. (Invited)

Nov. 4-6—Northwest Electronics Research and Engineering Meeting, NEREM, 16444th of Electrical and Electronics Engineers, Commodore Hotel, Atlantic Glenside, Tex. (Boston, Mass.)

Nov. 17-18—Symposium on Spacecraft Assembly, London, England. Sponsored by British and U.S. Air Line Pilot Associations.



4-STAR
TEFLON® HOSE
BY titeflex



"ZS" TEFLON HOSE

New Teflon hose assembly, exclusive with Titeflex, meets all medium pressure (1500 psi) Military Specification requirements plus:

- ★ Pioneered "ZS" (Zero Stress) construction with bifunctional Teflon. Isotactic eliminates potential electrostatic discharge failures in aircraft fuel and other fluid systems. "ZS" hose exceeds anticipated military demands for guaranteed conductivity in Teflon hose.
- ★ Newly developed "ZE" (Zero Effusion) Teflon has highest resistance to stress cracking and maximum gas effusion. After all resistance testing per MIL-H-12575B, gas effusion rate of "ZE" Teflon is less than 1 cc/in./mm. — its contrasted with effusion of standard aircraft quality Teflon of 10 to 50 cc/in./mm.
- ★ Progressively deformed fittings — developed specifically to exact the ultimate performance in Teflon hose.
- ★ Zero motion break for maximum flex life and resistance to hydraulic surge pressures.

To design this new hose into your product contact Titeflex immediately.



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*Teflon Gasket Treatment — Teflon Paints Applied For

the anatomy of a nozzle . . .

...by today's engineering, manufacturing and tooling world of fast, precise and unusual machining and fabricating capabilities.

Accurate, economical prototype and volume production of nozzle components and assemblies for solid and liquid fueled rockets is made possible by such advanced equipment as electrochemical and electrical discharge machines and numerically controlled, three dimensional contouring machines. Working with zirconium, tungsten carbide, tungsten moly, pure molybdenum, molded graphite, udonite, plastics, steels and other materials, Ex-Cell O turns ideas into reality. Call your local problem solver—the Ex-Cell O Representative nearest you—or send us your print or part requirements for a personal response.

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SOLID ANSWERS TO FLUID POWER PROBLEMS

For the critical tasks related to jet flight control in today's commercial and military aircraft, Lionel-Pacific has custom designed and produced all types of rotary and linear flutter dampers for ailerons and other controls.

This is another example of Lionel-Pacific's capability in providing solid answers to difficult fluid power problems. Frequently selected on a single source basis, Lionel-Pacific has long been recognized as a leading supplier—for all types of aircraft—of TOG (OG) internal locking actuators and rotary and linear damping devices. The company is now deeply involved in systems applications in control dynamics, cryogenics, fluid mechanics for military and commercial aircraft, tactical and long range missiles, manned orbital vehicles, and ground support equipment. We provide aggressive systems management capability, backed by solid financial support and a nationwide sales engineering organization. For applications information, call your Lionel-Pacific representative or write:

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A Forecast by
Dr. Walter Bart
President, Electro Instruments, Inc.

"You name it, we'll find a way to measure it," our broad experience keeps reminding me. I like that spirit, even if it can be only so far as the way of expensive disaster lies!

It men with a measuring breakthrough that Electro Instruments was born. Our original, simple, flexible, Digital Voltmeter was the first to substitute electronically driven switches for mechanical needle movement and drivers. It quickly proved itself an ideal instrument for speedier, more accurate, more reliable measurements—with useful applications in many industrial operations.

Now that time we have pioneered 20 other electronic "firsts."

These have led to ways of reforming many older measuring systems. But, more important, they have extended the areas in which our instruments, and our systems, can serve industry.

The end result is much industry employing measurement to economy—be it in personnel, time, materials, investment. Looking through our "eye lenses," I see across a number of outstanding examples of economy effected by use of Electro Instruments.

I thought we might usefully present these to industrial engineers everywhere, representatives, so that they might consider for their own operations.

Many modern, sophisticated, will have industrial measuring problems quite different from those listed in the examples. On this point, I think our engineers are worth re-reading. "You name it, we'll find a way to measure it."



Electro Instruments' solid state Digital Multimeter brings greater speed, better reliability to many jobs of measurement, and at a lower investment.



Electro Instruments offers the world's most carefully designed X-Y Recorders.

Spectra performance recorded without need for photography

In many industrial operations, recorded profiles are necessary for accurate identification of compounds, and for purposes of quantitative assay. Until now, connections such as early developed instruments capable of exciting molecules to a state of photoluminescence. Electro Instruments X-Y Recorders have proved a means of producing visual display of spectra without need for photographic equipment or processes.

500 man hour job cut to 33 1/3!

Teleoperating a job that once required 500 man hours into a 33 1/3 hour operation is no mean feat! Yet a system employing an Electro Instruments Digital Multimeter accomplished just that—for one of America's major aircraft companies.

What was involved was the testing of printed circuit boards. Each of 1000 cards produced daily by the company had to be given 32 separate tests for quality. It took an experienced electrical technician and inspector 15 to 45 minutes per card to perform the job.

In the interest of speeding up this tedious job, experiments with an automatic electronic testing machine were begun. The eventual solution proved to be a punched tape system—designed, incidentally, by one of the company's engineers—with an Electro Instruments Digital Multimeter employed as a key component.

Each of the 1000 cards are now given the 32 quality tests in less than 2 minutes—each result being displayed at the push of a button! ("Name an example")

Superior now offers you a new Super Alloy tubing—Inconel Alloy 718*—in precision-drawn sizes from .012 through 1.125 in. By Super Alloys we mean metals having 1000 hr. stress rupture strength at 1200°F and 25,000 psi minimum stress, combined with resistance to progressive oxidation and other corrosive attack. Inconel Alloy 718 is unique among the age-hardenable Super Alloys. Tubing made from it can be welded, then age-hardened, *without* necessity for—or cost of—an intermediate solution anneal.

Other Superior Super Alloy tubing alloys: Type 316, Waspette, A-286 (TMA, Alloygrade Stainless), Inconel Alloy 703, Inconel Alloy X-100 (TMA, Inconelgrade Nickel Co.), Hastelloy X, Hastelloy G, Haynes 50 (TMA, Haynes Nickel).

*See Associated Standard.

Tomorrow's tubing technology—today

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ELECTRO INTERNATIONAL, INC., ANNAPOLIS, MARYLAND • TRANSFORMER ENGINEERS, SAN GABRIEL, CALIFORNIA

WHAT MAKES AN INSTRUMENTATION CABLE FAIL?

It can pass inspection perfectly and corrode and fail immediately thereafter. Simply manufacturing it to spec isn't good enough. Because we spend failure time to find out the cable at every step from design to construction.

Where can it go wrong? At almost any point not adequately safeguarded. Here are four of the most common trouble spots:

- (1) Incompatible Plastics
- (2) Fillet Material
- (3) Component Lay-Downs
- (4) Shielding

INCOMPATIBLE PLASTICS: A unique form of chemical warfare within cable assemblies has lasted more than one missile program. Plasticizer materials have to be selected to correspond to obtain the required flexibility. These additives are seldom compatible with each other. Incompatible plasticizers used in systems in contact with each other without control may attack each other with disastrous effects. (As a prime example, solvents in low temperature neoprene jackets are not always compatible with the insulating materials.)

Manufacturers can control plasticizer migration problems by lacking proper materials and by using suitable barriers between components. Many specifications make the use of barrier material optional and a manufacturer whose only concern is price will leave it out.

Rome-A-Long as a result of its wide experience with materials always asks: "Where migration could be a problem."

FILLET MATERIALS: When spurious signals arrive at your display, recorder or control panel, the fault could be in the improper selection of fillet material. Closest duty between insulators and fillet materials is of prime importance.

In the case of some plastics or rubbers, the material's "memory" can cause it to bend disproportionately, causing undue strains internally. In the cable this can cause kinking of the insulated conductors, electrical failures follow.

Only experience can tell a manufacturer how to compensate for "memory" and how to control compatibility in fillet materials. Experience is what such as that has given Rome-A-Long its remarkable record of instrumentation cable reliability.



COMPONENT LAY FACTORS: Conductor kinking can also be a result of mistakes in the twisting of component conductors. Recommended tensions and improper sequence of lay-up can create uneven stresses in the assembled conductors.

In such cases, individual conductors may actually push through their insulation, causing electrical failures.

Obviously, these errors should be avoided during building. At the same time, cable construction control, experienced workmanship can provide safeguards against possible trouble later on. Such careful craftsmanship sometimes costs a little more but it can make the difference between success and failure.

SHIELDING: Construction of many kinds of the shields, shielding leads are prone to having broken and loose ends. These can break through insulations and short out component conductors. Improperly treated, they are the most common cause of shielding failures.

It's cheaper to fix such loose ends in the laboratory than it is in the field. The answer, experience on thousands of such shieldings has taught Rome-A-Long the exact techniques which must be maintained, as well as methods of protecting and testing loose ends.

HOW TO AVOID FAILURES: No manufacturer can promise you 100% reliability at every development stage. But its only logical goal is one way to be sure of outlasting reliability is to have your cable planned and manufactured by a company with depth of experience and a record of reliability in the field.

Rome-A-Long is frankly one of the few companies that qualify. We're been designing and constructing these cables since their first development—long enough to know what can cause a cable failure and how to avoid it. If you're planning to design or install instrumentation cable soon, call us.

At a distance, send for our 34-page booklet titled "Instrumentation Cables: Cable Assembly and Field-up Ways." In it, we describe instrumentation cable construction, production, delivery specifications and our qualifications. For your copy, send Rome-A-Long Division of Alcoa, Dept. 74-91, Rome, N.Y.



For the first time the proven advantages of the famous RCA 8056 triode tube are made use in a type specifically designed for low-voltage operation. The new RCA 8056, designed to operate from a plate supply of between 12 and 16 volts, at variable bias, is a wide variety of industrial and military applications, including mobile and aircraft communications, employing low-voltage circuits.

The 8056 is recommended for use in low-voltage and in amplifier circuits, control and multivibrator circuits, cathode follower circuits, and in other special applications requiring a device having a high input impedance and capable of operating at low plate supply voltages. When used with a low-voltage power supply, the 8056 can provide high gain with low noise in audio-signal amplifier applications at frequencies up to 150 Mc.

Desired advantages include:

- Small size and light weight
- High input impedance to achieve impedance matching, push-outs
- Substantially high voltage gain (approx. 1000) in 11.5 V Class A₁ amplifier circuit
- Low power drive
- Very high resistance to nuclear radiation effects
- Excellent reliability
- Ability to withstand severe mechanical shock and vibration
- Exceptional uniformity of characteristics from tube to tube
- Double operation over a wide thermal range
- Simple operation at any altitude

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If you'd like to receive further information on Duobinary Coding, or on any of our data modems, complete literature is available on request. Linkurt Electric Co., Inc., San Carlos, California.

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Shifting Winds

As a group that is influenced as strongly by the shifting winds of international politics and spurred to hard by the pace of modern technology, the aerospace industry must spend a great deal of its effort making out the first faint indications of these changes, and then carry their direction and impact accurately to determine how they will affect this industry's future. There are a number of strong politico-technical wind shifts in the Washington air that were hardly perceptible a year ago. The rate at which these trends can gather significant velocity, and the strengths with which they can change direction, is one of the major hazards of corporate piloting in the aerospace field.

The politico-technical climate the aerospace industry is facing this fall is quite different from that in which it comfortably entered the year last winter. Here are some of the rapidly developing factors that are changing the aerospace environment:

- **Increasing competition from Europe and Japan** across the entire technical spectrum from aircraft to space technology.

- **Sudden thaw in the cold war**, as indicated by the nuclear test ban treaty. Will this lead, as some people think, to major disarmament in a few years, or will it softly mean a major increase in the pace of defense technology to insure all possible safeguards against a nuclear attack by the Communist bloc?

- **Effects of the continuing civil rights conflict** on relations between the Southern Democratic congressional leadership of key military committees and the African nation's defense and space policies. Heretofore has already broken out against both the defense and space budgets for Fiscal 1964, and increased intensity of the conflict is forecast for the Fiscal 1965 budgets.

- **Growing isolation in the politics of the national space program** with the strong prospect that the size and character of this program may become a major 1964 presidential campaign issue.

- **Reversal of Defense Secretary Robert McNamara's** strong opposition to development of military space systems, and the possible beginnings of a major effort in this direction beginning soon enough to influence the 1964 election.

- **Application of the new Defense Dept. industry rating** policy, on profit determinations (see p. 37). As Fred Chermonty emphasized, whether this policy works well or becomes the biggest paper shuffler in Pentagon history, aerospace management must become expert in every detail of this operation as it develops.

- **Problem of maintaining an effective manned bomber**

force through the next decade, despite the phase-out of the technically obsolescent B-57 because of its shift to low-level mission roles and the effects of continuous airborne alert exercises, the phase-out of B-58 production, and the cancellation of B-70 and other follow-on manned systems development. If Defense Dept. lets this situation slide much longer, look for Congress to make an angry intervention.

- **Widening rift in the NATO alliance** over future roles and missions and types of weapons systems required. The fate of the NATO alliance will offer a strong clue to how this battle may be resolved.

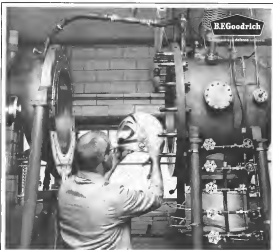
- **Increasing opposition of foreign airlines** to U. S. air transport policy on fares, capacity and bilateral negotiations. The marked trend of the U. S. passenger traffic shift to U. S. flag carriers on the North Atlantic last summer, as a result of foreign political backslapping to enforce higher fares, should have warned the foreign flag carriers of their folly. But it hasn't and the battle will be bitter at Salzburg.

Thus a by no means a comprehensive list of all the elements in the changing values of the aerospace equation, but it should provide a good indication of how sensitive to these shifts and often drastic changes the managers of the aerospace industry must be to avoid political shocks and the touch of technical obsolescence.

Perhaps no other industry is so closely interrelated with domestic and international politics as the aerospace industry has become in the past two decades, but there is no prospect that this will change. The vital task assigned to which the aerospace industry is virtually inflexible is to do this in the face of the power behind the modern world. Those nations that possess them must work hard to keep their explosives only sharp and their industrial base solid. Those nations without them are working feverishly to develop them as the power behind their international aspirations. The case of Red China, which has been working furiously to develop these key modern technologies during the past decade, and India, which now has virtually halphen except for what foreign technology may provide, are good examples of how these factors tie the international scene.

Although the eventual exceptions of the 1964 presidential election is only a faint moment at present, space and defense policy will once again be key issues, and the leaders of the aerospace industry should be devoting some thought now as to how to sail through the impending political storms safely.

—Robert Bots



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Bendix Products Aerospace Division



WHO'S WHERE

In the Front Office

M. Carl Hadden, vice president, command engineering, Lockheed Aircraft Corp., Burbank, Calif., succeeding Willie M. Hadden, AIA Sept. 7, p. 75. Hadden held well over 40 jobs in his position as president of the Lockheed-California Co.

Dr. R. F. Leonard, a corporate vice president, Aerospace Corp., Los Angeles, Calif., he succeeds Jack H. Boring as general manager of the Systems Research and Planning Div. Mr. Boring has assumed as director, Corp. Engineering at Princeton University.

Mack G. Blandine, group vice president, Defense Products Division, Allied Corp., Indianapolis, Ind. Blandine succeeds Mr. Hadden as division manager of Allied's Training Systems Div.

William H. Hellen and **Stef Karbit**, directors, Systems & Methods, Inc., San Carlos, Calif., a subsidiary of Technological Operations, Inc. Mr. Hellen is executive vice president and general manager of Systems & Methods, Inc. Karbit is vice president planning of Technological Operations.

Brig. Gen. John G. Zeeb, commanding general, U. S. Army, Missile Command, Redstone Arsenal, Ala. Also Col. Erik W. Berdick, commanding officer, Watkinson Arsenal Area, Missile Command, succeeds Col. Robert H. Brink as the Area Deputy Project Manager, Redstone Arsenal.

Honors and Elections

Edwin A. Leach, executive has been named recipient of the National Business Aircraft Association's 1963 Award for Meritorious Service to Aviation.

J. A. van der Stok, an aeronautical engineer at Arnold Engineering Development Center, has been selected by AECI Inc. to receive the first von Karman Grant, a monetary award is awarded annually by the company to merit in providing faculty members for the Training Center for Experimental Aerodynamics and Branch School.

James E. Wells, Administrator of the National Aeronautics and Space Administration, and **George F. Miller**, Chairman of the House Science and Astronautics Committee, have been named recipients of the Aerospace Electrical Society Management Awards for 1963. Mr. Wells was awarded a large presentation for his management of NASA's space program. Mr. Miller for his leadership in connection with the work of the House Space Committee.

Changes

William Dierksen, Washington, D. C., District Manager of the Atomic Defense and Space Group of Westinghouse Electric Corp. Also **William E. Douglas**, Arlington (Arlington, Va.) District Manager of the Atomic Defense and Space Group.

Leonard H. Wagner, manager of research group, General Dynamics Corp., Sacramento, California, succeeds Dr. William M. N. succeeding Dr. Leonard G. Mason, Jr. (AIA Jan. 3, p. 85).

(Continued on page 126)

INDUSTRY OBSERVER

Pathfinder, system design of a man-in-the-loop, airborne reconnaissance vehicle (MBRV) which can take control either in-flight or on the ground, to be used in conjunction with the Air Force's new F-105, the General Electric Model 6, the new Vehicle Design. General Electric controls is conducting a study of MBRV for the Air Force's Ballistic Systems Div. It is being created in the area of flight controls by the company's Light Military Electronics Dept. and the Sports Properties Co.

An F-105's Model Test Center at Cape Canaveral, Fla., is interested in dynamic properties for plotting attitude and vehicle velocity (responses with better capabilities than the older-than-newer) possibly planned for its new range control center (see p. 15). Only one after-seeing system will be installed, in the model's operations area. Television camera will pick up the response data displayed on the control area and then project them on adjacent area screen. USAF would like a faster, more accurate and economical system capable of directly accepting computer outputs.

Timeliness of a bomb damage assessment is critical, rather than would follow before the results into a target area to determine the nature and extent of target damage is being investigated by the Air Force's Ballistic Systems Div. The system would report its findings by radio link, perhaps through a radio link, communications satellite system.

Competition for a small, man-in-the-loop, airborne reconnaissance vehicle (MBRV) or "Bomber-Bomber", capable of being launched by a carrier aircraft, ballistic missile, may be conducted shortly by the Air Force's Ballistic Systems Div. After selection from the number of candidates, MBRV (AIA Nov. 26, p. 25) would launch on the electromagnetic radiation of hostile radar, probably crash onto a radio-antenna and perhaps survive the impact by continuous seeking, passing signals. This type of active position and a ballistic missile to the American Radar Radar, known as Strike or ARV (radio-antenna missile), being developed by Texas Instruments for the Navy and intended for use as launch against hostile radar. Companies known to be planning to enter the MBRV competition include North American Aviation's Columbus Div., Space Technology Laboratories and Texas Instruments.

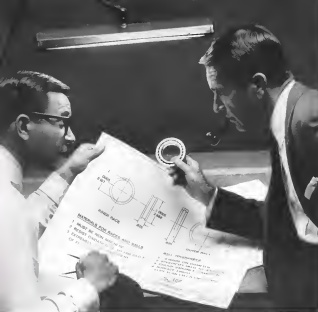
Testing of the Titan 3 two-stage engine and the Apollo service module engine has been delayed at the Arnold Engineering Development Center because of an unexpected break, without there. As F-105's Service Command said in additional testing program, it will get under way for the two engines as soon as additional instrumentation is installed.

Two interrelated research satellites carried piggyback on an Air Force Agena vehicle (AIA Sept. 6, p. 17) were launched May 9 by the same Atlas Agena combination that carried the West Ford double payload (AIA May 26, p. 14). Extra payload (designations for the 1.5-lb. interrelated satellites are 1963-14B and 1963-14C).

Radar reflectors tests conducted with the Piper Popcorn glass fiber airplane by Piper and USAF at Patrick AFB, Fla. have shown the potential to find about the radar cross-section characteristics of an aircraft. Piper's Popcorn, a prototype, however, has metal nose, fuselage and tail sections, which probably would be replaced by glass fiber in a production version.

Forecasting flying under poor visibility conditions is becoming a problem with the Air Force's new F-105 Air Support Div., which is testing the air support division concept. Forecasting lighting on aircraft is combining the pilots and viewing range. This separation is not a good alternative to forecasting flying in the air support, which calls for replacement of surface vehicles in such as possible with aircraft. With 75 Bell UH-1H helicopters in use for 14 hours, a 3-year interval would result in a total column length of about 4 ft.

Research of Naval Weapons is seeking qualified companies to develop an anti-aircraft computer system, without moving parts and using microelectronics to provide altitude, azimuth, Mach number, altitude-rate and related output signals. Interested companies must contact Code RAHV-5 by Oct. 6.



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TEF Probe Results

Washington Roundup

Senate Permanent Investigations Subcommittee's findings on the TEF contract award are likely to be presented in two separate reports, with door signs each. Sen. Sam J. Ervin, former North Carolina supreme court judge who reluctantly would support Chairman John L. McClellan, could break the tie. But he will say not sign unless report on grounds he has spent as little time on the investigation.

McClellan will be supported in his criticism of the Administration by Democrat House L. Jackson and Republicans Karl E. Mundt and Carl T. Curtis. Sen. Jackson is from Washington, home state of Boeing, which lost the competition. Democrats Edward J. Brooke, Thomas J. Malone and Daniel B. Brewster are expected to go with the Administration, while Republicans Jacob K. Javits of New York is almost certain not to attack a decision that benefited his own state in awarding Grumman, located at Bethpage, Long Island, its General Dynamics' piston sub-contractor to the TEF.

Sen. McClellan's report is expected to accuse the Administration of picking the second-best aircraft, condoning the "rough judgment" technique used by Defense Secretary Robert S. McNamara and the Air Force, and Navy secretaries in picking the winner; rep. Defense Dept. to avoid apparent conflict of interest in the future by disqualifying officials who automatically can benefit from defense projects, denying immediate and ongoing reforms in the Air Force's evaluation procedures—especially on estimating which the TEF investigation had been shown to be right—demand better documentation all along the line in defense contract decisions, and deny the Administration's efforts to achieve the nation's voice in weapons selections.

Red China's Air Force

Gen. Chang Ching-Kao, secretary general of Nationalist China's national defense council, said while touring Cape Canaveral, Fla., last week that Nationalist U.S. flights over the Chinese mainland have shown that the quality of the Communist Chinese air force "has deteriorated badly" over recently. The Red Chinese have not been "serving the world" equipped from the Soviet Union and they have been forced to cannibalize parts of their MIG-15, MIG-17 and MIG-19 fighters in order to field operational squadrons, he said.

Hostility was between the Soviet Union and Red China is strengthening ties between Communist Chinese scientists and the U.S., according to Air Force officials who have taken part in bilateral meetings in Moscow recently. More and more Chinese scientists are finding little new information in Soviet technical journals and are turning to U.S. literature. When the Soviets insisted on closing all four Canton center papers at a Moscow conference and forced down some Chinese entries, the Chinese declined information from the prohibited papers while presenting those that had been denied.

Research Crackdown

Congress showed it can be as busy to those away the rubber stamp it has been using on research requests when the House voted 356-0 last week for a resolution requiring a special research committee to conduct a one-year study of federal research programs.

Speaker John McConack (D-Mo.) named Rep. Carl Elliott (D-Va.) as chairman and the following as members: John B. Anderson (R-Il.), Clarence J. Brown (R-Ohio), James C. Cleveland (R-N.H.), John E. Fogarty (D-R.I.), Phil M. Landrum (D-Ga.), The Major Martin (R-Calif.), George P. Miller (D-Calif.), and Melvin Price (D-Ill.). Rep. Miller is chairman of the House space committee and Rep. Price is chairman of the new research subcommittee of the House Armed Services Committee.

The committee was directed to submit a report to the House by Dec. 1, 1964 on how much money the government spends on research and how well the efforts are coordinated.

Howard Hughes is unlikely to get any help from the Civil Aeronautics Board in his ongoing battle with Trans World Airline. Board spokesperson attorneys have announced it again after a Federal investigation of a Hughes complaint that TWA is being controlled by its leaders. The attorneys contend that the CAB does not have to act on the complaint unless Hughes wins Hughes against the airline, that now is before the U.S. Court of Appeals. In any case, the complaint was only filed to entice CAB help in Hughes' "private fight" with the airline and its leaders, the Board's attorneys said.

Afterthought Award

So did after D. "Binocular Helios" but due to a lack of manned space flight for the National Aeronautics and Space Administration, and nearly three months after the agency's other members announced by regulation. NASA got around to giving him its award for Outstanding Leadership. It made the announcement last that he had received the award on day after the presentation. Such awards usually are announced some time in advance.

No Experience Needed

To help NASA with its spacecraft sterilization program (see p. 34), U.S. Public Health Service has drafted Lawrence B. Hall to duty with the space agency as Special Assistant for Planetary Quarantine. —Washington Staff.

DOD May Manage National Space Station

Air Force readies bid request; NASA, USAF studies could lead to mid-1964 decision on a single design.

By Edward H. Kilgus

Washington—Air Force last week was preparing to issue project requests for conceptual configuration and system studies of a manned space station and proving indications that Defense Dept. has assigned management of a single national space station development program.

Results of both Air Force and National Aeronautics and Space Administration studies will be available for analysis next spring so that the U.S. could settle on a space station design in early to mid 1964. Those decisions that the U.S. will have only one program has been made but the timing is later because neither USAF nor NASA has yet put space station hardware money requests into the Fiscal 1965 budgets they are preparing.

Air Force expects to award a number of study contracts probably in early to 4 to 6 weeks after formal release of the proposed requests. The studies will be either fundamental, involving a study of space station requirements and capabilities. Air Force officials then, to direct specifications for a preliminary design. Air Force's long-range objective is to demonstrate, through study, the capability of a military space station.

NASA is spending about \$2 million in Fiscal 1965 money (AFL Feb. 22, p. 58) for 14 projects, studies related to space stations. Studies of the studies cover basic mission studies, called the 100-day Apollo, to a 24 man orbiting laboratory, called Orion. Major NASA configuration studies will end next March.

Air Force had hoped to award its own contracts by last month, but because of the wide scope of NASA's studies, USAF was told by Vice President Lyndon Johnson, chairman of the

committee—both, both parties have been urging. Defense Dept. for some time to state that there is a military use, now in space. Following hearings in the Space Task Force budget subcommittee, a group of Republicans was more emphatic and one of them, Rep. Donold Rumsfeld (R, Ill.) suggested that development of a military space capability in "inner" space was more important than developing an civilian mission of long duration.

At the point, Air Force's next draft bill contains that of concerning Defense Dept. creation of the need for the space station program. Under law of a secret subcommittee in the first stand against military manned space flight was Defense Secretary Robert S. McNamara's personal wording out of White House, State Dept. and NASA officials, and their feeling on the military space station.

In space station discussions, between the two agencies in recent weeks, on civil use technical and high-speed specific needs, indicating of which agency will support it, have become clear. Among them:

- **Persistent to increase the military space program** is almost sure to become a new in the 1965 presidential campaign.
- **Compassionate support for another NASA program** probably will be difficult to obtain as long as spending continues at a high level in Germany and Apollo program.
- **Sufficient management talent** to handle NASA's expanding program is becoming a problem. Project Mercury was ended after nine flights, not only because of a money shortage, but also to concentrate the available engineering talent on Gemini and Apollo.
- **Mission having** for military exploration of Mars is not in the 1960s—rather from early 1970s, or even in NASA, had hoped an accord in July (AFL Feb. 22, p. 54). This is the single key factor that remains an obstacle for NASA's need to begin space station development before high speed launchers are ended in the Gemini and Apollo program.

Air Force feels it needs an agency to develop a space station by 1967. NASA's primary focus, for a space station is to be used as a hub for military planetary missions. The existing station also is considered useful for general engineering research and development in areas, such as the operation of bearings in a low vacuum. Selection of launchers, development of the step-down stations and heat transfer (refrigeration) from a space station (compared the station might be used as a telephoto platform).

There are some in NASA who feel that if the agency can't find funding money that a USAF station will meet these requirements, management of the program should go to Air Force.

The problem White House must face in balancing all these interests against what is called the international space arrangement space flight solely for peaceful purposes.

Since NASA avoided space station study contains the view that has been attached to include potential Air Force requirements and systems. Key program in NASA is the manned orbital research laboratory (MORL) project, four-month studies of a 4.5 man crewed station was conducted by Blue and Deane, Inc. which were concluded Sept. 1. Initially the study specified use of Saturn I and Saturn IB launch vehicles, with Gemini and Apollo boosters.

NASA's request the studies at Air Force's request, NASA had the contract to conduct Titan 3 as a launch vehicle. In addition, Air Force and Aerospace Corp. were represented at contracts briefing sessions held at Langley Research Center, which is managing the MORL studies.

Meanwhile, Air Force added NASA to review its proposed space station with statements, and has changed the project name from MORL (orbital research laboratory) to NORS (national orbital research station).

Air Force's basic concept is quite an

due to MORL, in that it consists of a test of a laboratory and uses the Gemini as a ferry.

From a cost effectiveness standpoint, NASA has estimated that an Apollo-type space station could be acquired for a year for \$750 million, while a MORL-type station will cost \$2 billion annually to operate, and a large station a minimum of \$4 billion.

The Apollo 100-day space station could be used for more and its development would cost the least amount of effort. It is likely that NASA will continue to plan on this expansion of the Apollo mission no matter who gets the space station management responsibility.

If both agencies decide that the space station should proceed into hardware, state space agencies will be given clear program responsibility, and the other responsibility of the program. A planning board similar to the Gemini planning board will then be established to coordinate requirements.

If both feel there should remain the program, the other will be the program, the Air Force, Dept. NASA Aeronautics and Astronautics Coordinating Board.

The line of appeal then goes to McNamara and James E. Webb, NASA administrator, and from there to the space council. Failure to agree would require President Kennedy to make the decision.

Welsh Urges Civil Lunar Mission Continuation for Future Benefits

By C. M. Plummer

Edwards AFB—Civilian lunar missions could continue for its benefits to future peaceful and military programs, whether or not the Russians abandon their project, Dr. Edward C. Welsh, executive secretary of the President's National Aeronautics and Space Council, urged here last week.

Welsh said the civilian lunar project probably could contribute much of the key technology on which future military programs could be based. But he cautioned that the military must have its own projects to ensure complete knowledge of that technology. He pointed out that civilian projects could not be substituted entirely for military missions.

Welsh said a greater military role in space should be appropriated in addition to NASA's lunar landing program if needed, he said. He indicated that Defense Dept. had been moving too slowly toward developing a stronger military space role.

Welsh spoke at a symposium on

space exploration, man and machines. He suggested that with the advent of Saturn and Titan 3 boosters, and their greater payload capacities, reason to believe could be expanded to include non-military launches, direct ascent techniques and inspection and rescue operations.

In an apparent reference to the future role of the military in the national space program, he said that consideration should be given to replication, benefits and problems associated with such growth as a polar orbit. Its development is considered necessary for efficient satellite inspection and reconnaissance missions.

Referring to suggestions that Apollo should be devoted to military projects, Welsh said the importance of the Apollo program will be recognized in terms of the technological advances applicable to military defense. He added, however, that if civilian activities were curtailed the defense budget would be larger because better equipment is required to be developed by one agency or the other.

Wasp Development

Improved rocket booster system for helicopters, the Rocket Engine/Arrow Wasp, is under development by the St. Louis company.

A contract for the prototype system was awarded last week by the Army Missile Command's Air Vehicle Analysis Weapons Concepts Office, Redstone Arsenal, Ala.

The system is considered an intermediate in high-thrust, booster for one mission. It has a liquid motor, an automatic, complete package that the standard solid-state 2.75 in. tube motor.

Welsh also cautioned that it was essential to ensure that funds going in a contract of the lunar program could be automatically transferred to the military. Proper approach is to recognize the critical status of developing space capabilities as a matter of the nation, he said, and, in the future, the nation which will need the most in maintaining the peace.

As examples of technological talent from the lunar landing program to military space cooperation, he included personnel, materials, methods, structures, life sciences and guidance.

Welsh urged continued support of the U.S. lunar landing program, even if Russia delays such efforts due to its own program. He had little to say in recent statements that Soviet officials were dubious about the value, and execution of the possibility of putting a man on the moon, referring to them as possible Soviet competitive programs.

In support of the approach for the records of the lunar project, Welsh listed the following points:

- **The moon is the closest place in space** for testing equipment and men for future space travel.
- **Insights, orders and efficiency** will be improved by the military space program by such a clear objective.
- **Development of powerful rocket** on the moon will be a major step toward advanced and the capability to protect them against the hazards of space.
- **Progress in international relations** gained by a successful lunar project.
- **Benefits to standard of living, education and employment.**
- **Contribution to defense capability** in military space technology, life protective measures and guidance systems.

Welsh mentioned the high cost of the space program, but said that those who he said, lacked confidence, in the costs and scientific or economic strength.

"If their preferences were followed they could cut a billion dollars, leaving a gap of a billion dollars in more progressive nations in five years."

Low-Altitude Penetration Plane Studied

Washington—One of three aircraft concepts being studied by Air Force's Strategic Air Command and Defense Dept. is possible, future strategic weapons system. It has been designated X-40 for low altitude mission penetration.

SAC, Commanding Gen. Thomas S. Power told the Senate Preparedness Investigating Subcommittee to testimony before last week (AFL p. 10) that he would like some low-altitude aircraft existing in its smallest version.

He said he had selected "X-40" for the whole question "as the program that is going to be better than nothing."

"So in reverse order, I begin with the B-72—if you can put it back into production or keep the B-72 or bring the B-72 back into production, or design an aircraft that would meet more modern needs in a new way, that's what we call X-40."

Dr. Harold Boush, director of defense research and engineering, told the House Defense Appropriations Subcommittee last week that SAC and AFMAG were "seriously" studying a low altitude penetration aircraft, a high-speed, low-altitude mission (which is called X-40) (AFL Feb. 22, p. 54) and a high-speed mission aircraft (which is called X-41) (AFL Feb. 22, p. 54) and a high-speed mission aircraft (which is called X-42) (AFL Feb. 22, p. 54) and a high-speed mission aircraft (which is called X-43) (AFL Feb. 22, p. 54) and a high-speed mission aircraft (which is called X-44) (AFL Feb. 22, p. 54) and a high-speed mission aircraft (which is called X-45) (AFL Feb. 22, p. 54) and a high-speed mission aircraft (which is called X-46) (AFL Feb. 22, p. 54) and a high-speed mission aircraft (which is called X-47) (AFL Feb. 22, p. 54) and a high-speed mission aircraft (which is called X-48) (AFL Feb. 22, p. 54) and a high-speed mission aircraft (which is called X-49) (AFL Feb. 22, p. 54) and a 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NASA Losing Ground Within Congress

By Alfred P. Altamirano

Washington—National Aeronautics and Space Administration's relations with members of the House space committee have deteriorated so much since January that some congressmen who have been strong supporters of the space program are threatening to give the agency's Fiscal 1985 budget such nominal backing.

Many factors—some of them political, some involving NASA's Air Force rivalry account for NASA's loss of some of its standing on Capitol Hill. Principal factors are:

• **Reinforced** as NASA Administrator James E. Webb's attitude toward members of the House space committee, none of whom had he considers them "serious members."

• **Highly effective lobbying** by the Air Force for a military space program tied to the national defense and a completely ineffective selling job by NASA of its program—some of which went down from Air Force and even to the space agency when it was created.

• **Stronger stand** by Republicans, including members of the House space committee, against increased spending on civilian space.

• **Resignation** of D. Bennett Helms as NASA's director of manned space flight.

• **Relatively light** 1981 NASA space flight schedule, which several congressmen believe has not been designed enough to maintain public interest and support for the space program.

Webb Criticized

The chairman of the House space subcommittee—a ten-voting supporter of the NASA program—was especially critical of Webb's handling of congressional relations.

"He conducted us as necessary witnesses," the congressman said, "and he won't stop talking long enough to listen to us. It's pretty hard for us to cure the hell under those conditions."

"This is really the case when the Air Force does such a good job of advising and cultivating members of the House space committee. NASA leaves a vacuum and the Air Force fills it. It doesn't take too long for some of the members to decide they might as well support the Air Force."

Most frustrating development for the subcommittee chairman and other congressmen on the committee was the House vote last Aug. 18 on the House-Senate compromise bill authorizing a \$5.55-billion NASA appropriation for Fiscal 1984 (AW Sept. 2, p. 18).

Eleven of the 13 Republicans on the House space committee voted a motion which would have sent the conference report back to the House Rules Committee with instructions that the

committee direct the House conferees to hold the line at the \$5.2 billion authorization voted by the House. The motion was barely defeated, 200 to 176.

When the conference authorization fell to the floor, the House conferees on the space committee voted against the measure, which was approved 249 to 125.

Among the Republicans who voted to reinstate the conference report were Rep. Al Green (D-Texas) and Edward J. Gurnea (D-Ill.). Rep. Gurnea also voted against the authorization. Rep. Bill's district includes Denver, Colo., where NASA's new space shuttle is being developed by North American Aviation, Inc., and Rep. Gurnea's district includes Cape Canaveral.

One of the six that three Democrats who had voted against subcommittee and have since changed opposition of NASA's requests—Rep. Otto Tamm (Tex.), Joseph Kasten (Maine), and Gus Klotz (W. Va.)—are from districts which receive little federal aid in space work.

"It looks like NASA is in the middle," said one Democratic member of the House committee. "I'm not going to work for a NASA budget which can be a bookend of criticism of NASA at any time."

Rep. Gurnea said he doesn't think he will vote for the conference report. "I've got the contract," he said.

There is even indication that space spending will be even more of a prime concern next year. Recently the Republican Party's joint conference committee on space and aeronautics took House leader Rep. Charles S. Gibson (R-Calif.) has suggested an extension in a task force subcommittee on space objectives into these problems.

"Should we be in a race to the bottom?" and "What are the economic impacts of our space efforts?"

Still another space task force sub-

committee on the military role in space has been given as possible venue of investigation. "Should the Air Force be assigned a mission in space and outer space?" "Should we push ahead with plans for manned space platform?" "Is the air-maneuverable satellite program needed with sufficient urgency?"

Republican members of the House space committee have lately stepped up demands for a military space program (AW Sept. 18).

One member of the House is a leading advocate of such a program. It Rep. Donald Rostenfeld (R-Ill.). He has introduced a resolution, which was referred to the House Rules Committee, that would establish a select committee to review existing space legislation, to review existing space programs, and to investigate possible over-emphasis on the manned long-haul program and the need for a military space weapons system.

Moore Raced

Rep. Rostenfeld has said that the nation "could perhaps afford to lose the race to the moon, at least, there is no possibility of losing the race to Mars."

He said such a race would be a waste of money, a race for the dramatic demonstration of scientific and technological space competence. On the other hand, for our very survival we cannot afford to lose the race with the Soviets as they lay the national security aspects of space.

"There is a great culture of tension here when you get into the hard facts of the military race to get the information," he said. "I think the information is better prepared, data is much better job and provides the information more reliably."

One member of the House space committee and NASA told efforts of the North American plan at Denver not to provide a working definition of the U.S. position the highest state of military readiness on the Apollo program.

"NASA wanted us to live with the information that we were going to provide to the public," the member said.

"We had a very hard time getting the information we wanted, but we got it."

Revocation of Helms (AW June 17, p. 17), who some members of the House space committee aimed to force out of his job by the House acted outside the phrase of the NASA administrator's position, not many members of Congress. A few days after the announcement of the resignation, members of the House held a subcommittee hearing on the Helms resignation.

Rep. Helms gave a special word by the committee to show its appreciation for his work and in a tribute to Webb.

Aerospace Plane Funds Slashed

Washington—Defense Dept. budget tussling includes a collision in its Fiscal 1985 request for aerospace plane funds. The House wants to cut \$18 million in the Air Force request. The Air Force wants to cut \$18 million in the House request. The Air Force wants to cut \$18 million in the House request. The Air Force wants to cut \$18 million in the House request.

Funding for the \$8.451 series of aerospace development studies was slashed by \$18 million in the House request, \$18 million in the Air Force request, \$18 million in the House request, \$18 million in the Air Force request, \$18 million in the House request, \$18 million in the Air Force request.

Defense Secretary Kenneth L. Galanter in a letter to the Senate Defense Appropriations Subcommittee during its recent session said that because of the great 3% cut imposed by the House in Fiscal 1984 Defense Dept. research funds, the Department had to cut \$18 million in the House request, \$18 million in the Air Force request, \$18 million in the House request, \$18 million in the Air Force request.

He said the aerospace plane request was reduced by "cutting off all space-related programs, which, containing a reasonable level of effort on these programs which might eventually be studied in the design of a new high-speed aircraft. Thus there are currently no proposed or planned aircraft requirements for such an aircraft, this level of effort would be pushed solely in obtaining the state of the art in very high speed aircraft."

Sen. Everett Stenholm (R-Miss.), ranking Republican on the subcommittee, said his interest in the aerospace plane's funding was prompted by an article in Aviation Week & Space Technology. The article was written by the Air Force's chief of staff, Gen. William F. Reeser (R-Ohio), and was titled "The Aerospace Plane: A Vision of the Future."

Stenholm said that the \$18 million already committed to the Aerospace Corp. for building a concept engine testing facility at Lake Mead, Utah, "will be largely wasted" if the budget cuts withheld the additional \$18 million needed to finish it. Defense Dept. replied in a subsequent letter that even if the \$18 million was cut, the Air Force would still have the \$18 million needed to finish it.

Defense Dept. funding to date has been as follows: \$74 million in Fiscal 1981, \$18 million in Fiscal 1982, \$18 million in Fiscal 1983, \$18 million in Fiscal 1984, \$18 million in Fiscal 1985.

Stenholm is the most liberal funded contracts to date, but several others are involved (AW July 25, p. 24).

Senate Will Cite Test Bank Risks In Move to Restore DOD Funds

Washington—Senate this week will vote to restore some of the cuts in the House-passed Fiscal 1984 defense budget bill on the ground the risk of the nuclear test bank has been increased.

The U.S. position the highest state of military readiness on the Apollo program.

Senate Appropriations Committee is scheduled to send the bill to the floor this week. Debate on the test bank cuts may be interrupted by a show of force on the appropriations side.

Chairman Richard S. Russell (D-Ga.) of the Senate Defense Appropriations Subcommittee will argue that new is not the time to reduce military spending.

This view was buttressed by high Defense Dept. officials in the closing days of the appropriations hearings.

Defense Secretary Ronald L. Galanter told the subcommittee that cuts in testing and development spending would be a disaster for the nation's defense.

He said the nation's defense is in a state of emergency and that the nation's defense is in a state of emergency.

President Reagan's original request for \$18.437,000 for military personnel, equipment and maintenance, personnel, research and development, military construction and assistance to foreign arms are funded by Congress in separate bills.

Senate has reduced the requested amount to \$18,000,000, a cut of \$1,937,000, \$1,937,000. McNamara supported the Senate to restore only \$18,181,000 of

this cut, providing Congress would authorize transferring another \$247 million from working capital funds to military personnel accounts. He also plans to ask military personnel appropriations to cover additional military personnel costs.

Senate is expected to action most of the House cuts in several present and future sessions.

(AW July 25, p. 20). Even then it is whether one or all of the available quantum-bolic nuclear (MMIRM) money request will be reduced. House studied the \$18.437 million request in \$45 million, and McNamara had not requested restoration. But Gen. Taylor had requested full funding of the MMIRM, partly on grounds it would free many aircraft assigned to the North Atlantic Treaty Organization for other duties.

He said the House-passed bill would delay the program a year to 18 months (AW Aug. 16, p. 26).

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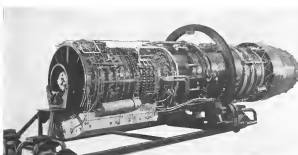
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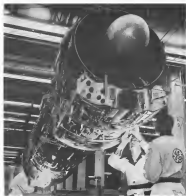
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GENERAL ELECTRIC GE-3 Mach 3, 30,000-lb thrust J93 turbojet engine, shown at AFA meeting, was developed for USAF North American B-70, but may form the basis for GE's participation in a design competition for a supersonic transport propulsion.

J93 Viewed as Basis for SST Powerplant



TECHNICIANS ASSEMBLE the control and accessory pack for the General Electric J93 turbojet. All control systems are protected against high temperatures generated at Mach 3.

Washington—General Electric Co. unveiled on March 3, 10,000-lb thrust J93 turbojet here last week, and indicated the development experience with this engine would form the basis for its participation in the Phase 1 design competition for a powerplant in the Federal Aviation Agency's supersonic transport program (see p. 49).

General Newman, general manager of General Electric's Flight Propulsion Div., said the J93 is its present form would not provide sufficient thrust for a Mach 3, four-engine transport, but that its basic configuration could be used to develop the experience from past experience by the addition of either a after stage to the compressor, adding up to 20% additional air flow, or by the incorporation of an after fan design.

The J93 engine scheduled to power the North American B-70 Mach 3 bomber was delivered to North American last week, after they posted a 65-hr preliminary flight testing test that included 15 continuous hours of running under simulated Mach 2 conditions.

The J93 follows the traditional General Electric development line for super-sonic engines. It includes variable inlet and compressor vanes, which are used on all stages, single speed compressors, and exit passage into and the use of split casing for the compressor, combustion and turbine sections for easier maintenance access. The J93 is just 3-in. short

of 23 ft long including its afterburner, which functions as an integral part of the engine. It has a maximum diameter of 55.5 in. and thrust-to-weight ratio of better than 5 to 1.

The two-stage turbine utilizes new high temperature alloys and air-cooled blades. The engine uses a hybrid mechanical control system.

Special attention was given to its design to problems arising from the high temperatures generated by Mach 3 operation. An intricate induction heating process was developed to provide solid, leakproof connections on all fuel, oil and hydraulic lines. All control systems are housed in a special access panel made of heat-treated materials to insulate it from heat radiating on the engine. The access panel is also cooled by fuel flow and is kept at temperatures too low to require protection area of fuel flowlines occurred within the jet.

The J93 has a continuing developing type experience adding development experience gained from the J79 after burner development.

Most of the technical and performance details on the J93 are still classified. Technical groups at the B-70 engine took place at a special high speed facility built by General Electric at Elyria, Ohio, the USAF Air Engineering Development Center at Tyndall, Fla., and a North American facility at Santa Barbara, Calif.

The J93 will get its first full scale flight testing in the initial flight of the B-70 expected this fall. The J93 was first flown about a USAF B-55 in 1963 (AW Jan. 13, 1966; p. 164).

Earle Named to British Defense Establishment

London—Air Marshal Sir Alfred Earle has been named vice chief of defense staff for the new British defense establishment, effective May 1. He replaces Lt. Gen. Sir Alan DCCann, who is named as commander to Earl Mountbatten of the Navy.

Other key appointments. Air Vice-Marshal Sir Walter Pater, an efficient communications officer, is named to be deputy chief of the defense staff (personnel and logistics) in March.

Vice-Admiral Sir Norman Denning, director of naval intelligence and chief naval supply and secretariat officer, is named deputy chief of defense staff (intelligence) in April.

General Sir Rodney Mowbray, chief of the Armed Forces Staff Federation of Malaya, is to be defense service assistant on March 1, and is to be replaced by Captain W. J. Padley, R.N. captain of Britannia Royal Naval College, Dartmouth, to be assistant chief of the defense staff (operational research).

FCC Procurement Restrictions On Comsat Corp. Are Protested

Washington—Communications Satellite Corp., the government-owned satellite communications carrier, has protested two industry associations have protested strongly against procurement regulations proposed by the Federal Communications Commission for the commercial space communications system (AW Aug. 19, p. 35).

In addition to the Communications Satellite Corp., changes in the proposed regulations were recommended by Aerospace Industries Assn., Electronic Industries Assn., American Telegraph & Telephone Co. and General Telephone & Electronics Corp.

Respondents to FCC request for comments acknowledged the Commission's authority to promulgate procurement regulations, but the Communications Satellite Corp. and participating carriers, but objected strongly to making their prime contractors and subcontractors subject to the same regulations. General Telephone Co. has decided that it was not the FCC's intent to make subcontractors subject to the notification procedures, but conceded this point might be unhelpful in the regulations as proposed.

Respondents also urged the FCC to raise the threshold value of contracts for which procurement details and source of material required must be filed with the Commission from \$2,500 currently proposed by the Communications Satellite Corp. urged that it be increased to at least \$10,000, a figure which FCC spokesman recently indicated would be willing to accept (AW Sept. 1, p. 71). American Telegraph & Telephone Co. recommended the figure be increased to \$100,000, while EIA urged a figure as high as \$250,000. The Electronic Industries Assn., urged the use of other criteria, such as the amount of government funds in interpretation that the regulations would apply to subcontractors.

In support of the \$100,000 figure, AT&T cited its own 1964 contract with the government for a satellite system exceeding \$2,500 awarded by the company, 75% of the total dollar volume was made up by 75 contracts which exceeded \$100,000. The remaining 75% of the contract was made up of 1,000 contracts, representing only 25% of the total.

Communications Satellite Corp., and the proposed regulations, "would seriously impede the establishment at the current practicable date of a global communications network," and recommended that FCC abandon completely its plan to require even the company and common carrier to file notice of intended awards and details of procure-

ment procedure excepted for contracts over the threshold value, and suggested that FCC merely be notified after the contract was awarded.

Under the original FCC proposal, the award could be made under the Commission's notified the procurement contracts to the industry within 10 days. Commission officials explained that the intent was not to require FCC approval or disapproval of the choice of contractors, but to assure that procurement competition procedures had been followed.

A Commission spokesman said the industry comments are being studied and that the FCC now has an open hearing on the subject now. He emphasized that the Commission's intent is to comply with the provisions of the law which created the space communications commission to assure "that government contractors be encouraged" in the production and development of space communications equipment, have historically shown a preference for buying from their own subsidiaries, and that the FCC seeks to assure that outside companies will have a fair opportunity to compete for the new space communications business.

Japan's Itoh N62-160 To Fly in November

Tokyo—Itoh N62-160 four passenger jet is scheduled to make its first flight in November. The aircraft is to be completed soon. World War 2, is scheduled to make its first flight in November.

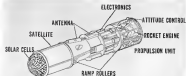
Designed by C. Itoh Aircraft Manufacturing & Engineering Co. Ltd., the N62-160 will be powered by a 1,040-hp Lycoming engine and have U.S.-made instruments and accessories.

The company has applied for U.S. Federal Aviation Administration certification under FAR Part 23. First deliveries are scheduled for April at an estimated price of approximately \$15,000.

Itoh plans a monthly production rate of six aircraft. Export orders will be concentrated mainly in South-east Asia and the U.S.

The N62-160 has a wing span of 35 ft 5 in., a length of 23 ft 10 in. and a height of 8 ft 10 in. Empty weight is 3,350 lb and gross weight is 5,500 lb. Cruising speed is 124 mph, the service ceiling is 19,000 ft and the range 620 nmi.

Itoh is planning a 280-hp version.



SATURN Payload, Trajectory Profile Shown

An Air Force General Dynamics/Astronautics satellite recovery mission (SATRE) surfaced and trajectory profile are shown in these drawings. The SATRE project first reported by *Air Force Week & Space Technology* (AWF 11, p. 49), was the result of the satellite just launched on Atlas F inside during ballistic tests. After separation, the SATRE pod will coast about 900 sec. before the solid propellant rocket engine ignites to provide initial velocity. The engine will be primed after burnout. Pod can turn a 100-sec. period into an elliptical orbit with a 1,600-sec. apogee or a 100-sec. period into a 900-sec. orbit. An Air Force and General Dynamics was given a \$10-million contract Sept. 15 to build five SATRE pods, which will be 12 ft. long and 30 in. in diameter. SATRE is part of an expanding USARF payload satellite program (see p. 20) which in the past has included similar payloads operated from Agena stages (AWF 70, p. 20). SATRE was officially announced by the Air Force Area command last week in Washington, where USARF also reported it will orbit, probably as a payload, a biological fuel cell, developed by Alfa-Chemtech and developing 10 in. over a 90-sec. lifetime.



Spacecraft Sterilization Relaxed

Washington—Sterilization procedures for future Ranger and Surveyor lunar landing spacecraft have been relaxed to eliminate the long lead time, because it is believed that the present degraded performance contributed to Ranger failures.

In a statement of policy, National Aeronautics and Space Administration said it still plans to sterilize Mars and Venus planetary lander spacecraft by cooking them in heat, unless some extraterrestrial organisms are not heat resistant.

—as proved to be the case in Ranger II this week, NASA's policy will be "to sterilize Mars in other methods and then incorporate them into the already sterilized spacecraft by sterile assembly techniques."

Lunar lander now will be assembled in clean room and spacecraft agents will be used on exposed surfaces. The Ranger II, launched next week, was sterilized by baking components and then subjecting them to 24 hr. heat cook at a temperature of 265F. After heat as-

sembly and sanitation into the furnace, the spacecraft were cooked in an atmosphere consisting of 80% fluorine and 12% ethylene oxide for final surface sterilization.

This sterilization treatment was found to degrade television tubes, solid propellant for motors, tracer crystals and tubes.

Plaster flybys spacecraft, which will not be sterilized, will be flown on a trajectory so that the probability of impact is one in 10,000, NASA said.

Link, Lockheed Win Space Trainer Awards

Washington—Link Div. of General Precision has won a \$1.1-million contract to build a mock trainer for space intercept and rendezvous, and Lockheed received a \$74,500 contract to study and develop a preliminary design for an orbital docking and abort retrieval simulator.

An F-4C jet the Link division will be put in use in mid-1964 and will be able to simulate the in-flight characteristics of any manned spacecraft yet conceived. It will be installed at the Aerospace Research Pilot School, Edwards AFB, Calif.

Initially, it will have a maximum climb, with provisions for making it a two- and three-man pilot.

The crew complement will be four, as that a variety of payloads will permit the crew to maneuver it through 180 deg. at an end 30 deg. of pitch, yaw and roll.

Lockheed's study will consider use of an extendible tubular docking tunnel for orbital connection of two spacecraft. This contract will run through next March.

X-20 Communications To Get Airborne Tests

Washington—An F-4C and B-52D Corp. of America is a few weeks will begin integration and compatibility tests of the Boeing X-20 (Dyna-Soar) communications system at the Washington, D.C., airport. The system uses super high frequencies to increase the ground-to-aircraft link which could block space-ground communications for as long as 30 min. during reentry.

Communications system will be tested for about 300 flight hours in a Boeing KC-47 at altitudes of 30,000-15,000 ft. Low-altitude communications will determine minimum acquisition capabilities and signal quality.

The USAF-RECA will test about eight months.

Prototype worldwide range stations for X-20 will be built at Cape Canaveral, Fla., and Edwards AFB, Calif.



Charles Scobee speaks with authority on space man's destiny.

This man's aluminum is going to the moon



Renewal of Three-Class Service Expected

Favorable CAB view on low-fare plans, new traffic records are seen as keys to permanent certification.

By James R. Ashlock

New York-Airlines seeking to reduce the current variety of fares and services offered between Chicago and the West Coast are finding their steps unobstructed by lack of any closest evidence that the arrangement is harming business.

Primary target of complaints is Continental Air Lines' three-class service between Chicago and Los Angeles. Its renewal is to be determined at hearings opening Sept. 21 before the Civil Aeronautics Board.

The service, already renewed once is due to expire Oct. 25. That time, Continental will ask the CAB for permanent certification.

United Air Lines' single-class program is considered an antecedent by both Trans World Airlines and American Airlines. But both TWA and American, competing effectively with their low-fare class service on Chicago-SFO and SFO, expect conflict to co-exist with United's management as long as they aren't pressured to adopt a similar service.

Improved Volumes

Industry sources are speculating that Continental will have little difficulty in gaining reinstatement of its three-class program. Passengers released from Chicago weekend, like those denied elsewhere domestically, are improving for both Continental and its competitors. And the CAB's inclination to low-fare proposals remains unchanged.

Inconsistency, deletion of revenues

and diversion of non-stop transcontinental traffic through Chicago are the primary changes against Continental's service. However, even the approach admits that such arguments can't block its return. The CAB itself is so much in the fact that new handling records are being established.

"It's a bad time to argue fare changes," an official at one of Continental's competitors said. "But we still can't see the concrete sense of this three-class service."

TWA, United and American remain convinced that Continental's single class pose a continuing threat to the three-class program as well as to attract transcontinental traffic through Chicago with the SFO service.

The three-class service often are almost constant loading at the rate of the airport at a low 20% below peak north-bound. Business class with first-class service in the middle of the week is 12-15% below first class. Pass-

enger in the first-class section remains on hand.

American said that before Continental's move, the great percentage of transcontinental business there was stop schedules. But in the fourth quarter of 1962 a survey revealed that 12% was no longer after than non-stop flights. American said that indicated diversion to Chicago and the lower economy fares.

"It is not adequate for someone to buy a first-class ticket to Chicago to get the meal and bar service, and then transfer to the economy section for the rest of the flight to Los Angeles," an American spokesman said.

American, United Problems

Continental sees its themselves job exclusively on routes where the fare gap. But American and United, in continuing search for ways to solve its problems, face problems when not just require from these airlines, out of Chicago. Unless there are enough passengers willing to pay single class fares for reasons such as better service, the airlines can be crowded empty. This is a key to the complaint of transcontinental.

"Of course, it isn't rough on So," one transcontinental carrier official said, speaking of Robert F. Sox, Continental's president. "While we're carrying empty seats around, he's looking out traffic out of Chicago."

Continental claims that traffic is being diverted through Chicago, and in fact that most of the increase in traffic



Work Progressing on New LaGuardia Terminal

Outline of how the LaGuardia airport terminal complex will appear when completed is shown in this aerial view. The new control tower stands in foreground, a 100 ft high structure, which will cost \$125 million, is scheduled for completion in 1964, before opening of the New York World's Fair. Plans include extension of two runways to 7,000 ft, replacing LaGuardia for medium stage jets.

is generated from that city and the rest surrounding area.

One figure indicates there has not been much decrease in what does shift in to Chicago a significant lower traffic," a Continental spokesman said.

Figures from both the CAB and the Interline Clearing House are referred to by Continental in its claim. TWA says it has observed "a very definite shift of transcontinental traffic through Chicago. And American feels that the economy class service has generated at least a 10% increase in new business."

But the day is 28% below regular at each, which isn't justified by only 15% more traffic," one official said. "And we have observed that no more on the people diverted out of the regular coach section."

Airline Doubts

Whether the low fare is actually accountable for the increase in Chicago-West Coast traffic remains a question. Consequently, some airline officials feel that the sacrifice of the first-class section would be a net loss.

Since TWA, United and American are watching Continental's success fare and its business fare that is 15% below first class, they are saying a good deal of the lower fare traffic from Chicago. But they feel that the seats are at a price too low for the service and below what the public is willing to pay.

They also claim that the diversion

through Chicago comes just at a time when there was evidence of an uptick in the local decline of transcontinental nonstop traffic. In the first three quarters of 1962, there were 73,432 nonstop flights from New York to Los Angeles. In the last period of 1962 the number had dropped to 58,756.

The CAB, however, can consider on the basis of bookings acquired by the figures being reported in it. Almost even carrier in the month has reported August as the best month in its history. American, for example, flew 721 million revenue passenger miles during August, 17% over August last year.

Continental said that in the first year of its three-class service, the main carrier of which was Aug. 24, revenue passenger miles on routes where the fare gap was 15%, and transcontinental revenue passenger miles rose 25%.

Developments also indicate a good increase in transcontinental passenger volume, although not all of it zero nonstop traffic. A United spokesman said that New York to Los Angeles flights were up approximately 20% so far this year. New York San Francisco carried about the same. The two cities, he said, despite a "considerable diversion of New York-Los Angeles traffic to the southern transcontinental route."

Revenues of United, TWA and American also are up sharply on routes out of Chicago. American, in fact, rose up 57.5% over revenues earned on these routes in January and February. TWA was up over 90%, and United,

comparing on a large base since the 1950s, rose up over 48%.

United has a specific reason for opposing the Continental three-class service: the low economy fare is blocking out of its single-class plan into the Chicago-Los Angeles market. From Chicago to San Francisco the \$111 single-class fare is proving satisfactory despite the lower \$59.50 coach fare offered by TWA and American on their Coastair jet. But United isn't ready yet to gamble with the SFO economy competition into Los Angeles.

United Service

While TWA and American feel the public still wants on a choice of carriers, United is planning further expansion of single-class. It will begin increasing 19-20% its single-class seating later this year, and its 40 Boeing 717 medium-range jets now in order will come with that configuration.

The slighter logic for coupled with strong first-class loading and increasing passenger capacity in United's situation, has more than compensated for any coach traffic it may have lost. And of \$50 major business lines that previously restricted passenger to coach travel on business, 584 have now entered single-class fares as acceptable for the expense account.

American questions whether United is really doing as well in passenger growth with its single-class fare. United's system-wide increases an approx-



Capital Airways Takes Delivery of DC-8F

Capital Airways has taken delivery of the DC-8F jet from Douglas Aircraft Co. The transatlantic configuration version will use the transport as commercial charter service and as contract service for Military Air Transport Service of USAF. The aircraft will cruise at speeds up to 575 mph, carrying 165 to 180 passengers. Range capability extends up to 3,600 mi.



Photo of Anglo-French Concorde supersonic transport baggage details (above) also includes the use of a F400 FD-2 (box cart), covered and skid for use in Bristol Type 221 supersonic aircraft (AW Oct. 13, p. 102).

to maintain this size, American rates from CAB figures are not as great as they were in the same months a year ago before single-class service.

But earlier TWA and American are complaining about single-class too much, since they are doing so well despite it on the Chicago-San Francisco run.

In June American carried 20,100 Chicago-San Francisco passengers, up 93% over the average for January and February. TWA, with 14,700 passengers, was up 90.6%, and United's 15,700 passengers represented a 45.9% rise over the year's first two months. Unofficial figures for July and August indicate even larger increases for all three carriers.

United officials say that single-class service accounts for 42% of all its Chicago-San Francisco traffic. The service, they say, is accounting for the best load factors on United's system, running as high as 84% on days when the carrier's system load factor is around 55%.

Although it would like to see Continental's three-class service removed from the Chicago-San Francisco route, United is still carrying 16% of the traffic on that run, tops among the four carriers flying it.

One-Class Fare Stems Shift From Coach

By L. L. Doty

Washington — Domestic trunkline traffic figures for August indicate that the shift from coach to first-class travel at the south of the line-of-flight fairly high (AW Aug. 18, p. 56) is occurring largely on long-haul routes and apparently is being carried at United Air Lines by the single-class fare.

Traffic activity during the month indicates a continuation of the coach-growth pattern that developed earlier this year. However, the greatest direct use of coach traffic is first class during the past two months occurred at TWA and American Airlines. United and one of the smaller trunklines showed little or no increase.

Reorganization in first-class load factors brought about by the coach plan is causing the industry's deep concern, since the combined carrier for first-class passengers is less than the cost of an equal number of coach seats. For example, in both business and pleasure travel, first-class load factors are in the low- to mid-40% range.

So far this year, however, first-class travel has shown a marked sign of recovery. During the first eight months of the year, first-class travel rose 1.7% while first-class revenue rose 4.4%. This is not a spectacular increase when compared with the 37.8% boost in coach traffic during the same period, but it is a particularly significant one, considering that the industry's decline in first-class travel experienced by

the industry in the previous two years. Furthermore, while first-class load factors climbed from 47.8% in the first eight months of 1962 to 50.9% in the same period this year, coach load factors fell from 75.7% to 74.7% during the same comparative period.

Part of the effect the increasing popularity of the family plan will have on gross revenues has penetrated the airlines to petition the Civil Aeronautics Board for permission to reduce the family plan rate discount from 50% to 40%.

During the month of August, American's first-class revenue passenger miles climbed 71% compared with July, August, 1962, and TWA's jumped 18%. First-class reported a 17% increase in first-class revenue passenger miles and Continental will show about a 9% increase. All other trunklines except United will report a decrease in first-class traffic. United reported a 9% rise in first-class revenue passenger miles and a 6% increase in coach traffic for an overall 1% improvement during August compared with the same month of last year.

It should be noted that a small percentage increase reported by United, although not impressive when compared to that of other carriers, actually represents a considerable volume of traffic. Single-class available seat miles dropped 4.4%. This is not a spectacular increase when compared with the 37.8% boost in coach traffic during the same period, but it is a particularly significant one, considering that the industry's decline in first-class travel experienced by

Bozell Airways during a 17% increase in first-class traffic, but the airline has consistently believed that its more liberalized routes do not justify coach service as it has shown here a sharp increase of 17% in first-class service. Continental Air Lines will report about a 40% increase in first-class traffic, reflecting the close competition for family plan business with transcontinental carriers on its Los Angeles-Chicago route.

Continental's business in its other two classes did not appear to suffer as a result of the increase in first-class revenue passenger miles. The airline reported a 90% improvement during August in total revenue passenger miles flown—131.3 million—the highest mark reached in the company's history.

Both American and TWA also reported record traffic volume for August. American has continued that revenue passenger miles for the month surpassed 721 million, a 17% increase over last August's total. TWA's domestic traffic reached 598 million, a 26% gain over August a year ago.

The trunkline industry established a new record in August with 3.5 billion revenue passenger miles, a 21% increase over August last year. Available seat miles rose 19% to give the industry a 60.1% load factor, highest level reached since June, 1961.

Local service airlines registered 177.7 million revenue passenger miles in August for a 45% gain. Available seat miles rose 34% to 1.55 billion, to give the local service carrier a 47.7% load factor for the month, highest mark reached in the history of this group.

Concorde Cabin Details Shown



Interior of Concorde cockpit at Bristol Aircraft production plant in England shown here about testing in new passenger compartment (AW Sept. 9, p. 40). Aisle seats will be 19 in. apart. Cabin height is 77 in.

748 Weight Boost

London—Maximum takeoff weight at the Aero 748 turbojet transport has been increased from 42,000 lb to 43,500 lb. Correspondingly, maximum landing weight for the aircraft has been boosted from 40,000 lb to 41,500 lb.

The company says the extra 1,500 lb of disposable load can be utilized by aircraft operators in several ways, such as carrying heavier payloads over greater distances.

With the high-speed 30-mph jet engine, steps can be increased to 1,000 mph, placing turbojet-powered aircraft into service from major British airports.

With a 40-mph and improved range of 1,700 mi. with full passenger, other carrier operators may consider methods of making North Atlantic coast routes, the firm says.

The new weight increase has been achieved with a minimum alteration to the basic aircraft structure.

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FAA Tracking Facility

Position aircraft radar tracking facility for the Federal Aviation Agency will be today, automatic tracking, without and other use of remote control will be added, according to the Federal Aviation Administration, Dept. of Defense, Corp. of America.

New facility, scheduled for installation at FAA's National Aviation Facilities Experimental Center in Atlantic City, N.J., next spring, will be one of the nation's most complete integrated radar tracking facilities according to Bureau.

The ground radar is to be designed to provide the position of aircraft with an accuracy of no more than 0.1 mile, even pointing to less than 300 yards at a distance of 100. Facility will include systems for both analog and digital data recording. In 144, extreme will be located, minimum, pointed against wind and other strong disturbances.



Which linkpin would you choose?

Each of these look-alike linkpins was sold as a replacement part for Pratt & Whitney Aircraft's famed R-2800 engine.

The linkpin on the left is a "harpain price" engine part. The linkpin on the right is a Pratt & Whitney Aircraft original equipment part. Although the harpain linkpin resembles the genuine part, it is made of metal that is too soft for this application. Cracks which begin in minute defects beneath its plated surface could result in failure, causing major engine damage.

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Alitalia Service Resumption Planned

Rome—Alitalia hopes to resume full scheduled service this week after a crippling strike that forced the Italian carrier to cancel the majority of its international and domestic schedules.

With the aid of temporary personnel, the airline managed to maintain service Douglas DC-8 jet schedules to North and South America, South Africa and Australia. Self-converted freight and Vickers Viscount turboprop transport services also were maintained to Frankfurt and Tripoli.

All other schedules, including the complete domestic service, were canceled for the duration of the strike, which began Sept. 7.

The weekend by 90% of Alitalia's work force was released by three unions representing Italy's major political parties—Christian Democrats, Communists and Social Democrats—in a bid for higher wages. They were to return to the job Sept. 14.

An Alitalia spokesman said last week that the workers rejected a pay raise schedule proposed by the airline as insufficient and then called the walkout without further negotiation. Wage talks, including a new Alitalia proposal, are scheduled to begin later this week.

Canceled flights included daily service to such major points as Paris, London, Madrid, Athens, Rome, Amsterdam, Geneva, Zurich, Vienna and Warsaw in Europe, plus several points in the Middle East, Africa and the Far East including Hong Kong and Tokyo.

Domestic schedules included scheduled flights to Milan, Naples, Turin, Venice, Genoa, Bologna and Palermo.

Alitalia managed to maintain its three flights a day scheduled to North America as well as its normal frequencies to South Africa, South America and Australia. South America and South Africa are served three times weekly, while there is a single flight per week to Sydney via Bombay, Bangkok and Singapore.

American Engineers Cancel Strike Vote Following Mediation Request

New York—American Airlines applied for federal mediation last week in its contract dispute with the Flight Engineers International Assn. (NWE Sept. 9 p. 47).

The move came as the master executive council for the 500 members of American's FEBA chapter was considering a strike that would it and would interrupt service by the National Mediation Board. A decision on the strike date was to have been reached Sept. 12, but was called off Wednesday when American announced that it had requested mediation.

Spokesmen said, however, that the engineers had American has accepted an indifferent attitude on that contract demands.

Officials of American's chapter of the Flight Engineers International Assn. felt interest there would be no strike. But the threat was made, they said, to force prompt federal mediation.

The engineers have been without a contract since May 1.

The engineers are also disappointed that the arrival of J. J. Farrow, American's new vice president, prompted him brought no change in the stalemate. Formerly with Eastern Air Lines, he was instrumental in offering that company's engineers the terms of the Franchiser Agreement. Although it seemed of interest, the terms are considered unsatisfactory by the engineers of American.

Farrow had had time to become settled over there, but he's received no more encouragement since he arrived than he had before," Schwartz said.

The American engineers have not had a pay increase since 1958, and currently work without the duty pay provisions afforded the pilots. Under the duty pay, pilots receive flight pay compensation for the time they are on duty, but not necessarily flying.

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The engineers demand a similar duty provision. Without it they say, they serve without pay as much as 15 hr more a month than engineers on other airlines.

They also want the more flight time reductions recently granted the pilots. Those went for a 75-hr. month on jets and 90 hr. on propeller aircraft, rather than 115 hr. on propellers, at the same pay. Engineers still are on an 115-hr. basis.

American plans to put the new hourly scale for pilots into effect on its Boeing 700s on Oct. 1, and on its Boeing 707s on Nov. 1. Initial reduction of cockpit crew size from four to three men will also begin Oct. 1, with the third pilot stepping out. The move involves no reduction in American's overall pilot complement, since some captains and copilots will be needed due to the reduction in flight time.

The strike came near shortly after the engineers had won a court injunction under which American was told to maintain the dues checkoff for their union. The check-off provision stands in the company's decelerating drive from engineers' paychecks and sending them directly to FEBA headquarters.

American claimed the checkoff agreement was a part of the expired contract and need not be continued. But the engineers, who depend on checkoffs to make union funds more readily available than can be obtained by individual members' payments, other than it as an amendment and filed for its injunction.

Judge I.B. Weiss of the U.S. District Court, Southern District of New York, granted the injunction.

Labor Peace

"Labor peace in the air carrier industry would be promoted by maintaining the status quo [of the present contract] while made to reach agreement," Judge Weiss said. "It is difficult now how to use the authority of stopping the dues checkoff, the union would again have to sue over the issue."

Judge Weiss said it was obvious that stopping the checkoffs had harmed the union, and that it was difficult to see what circumstances would lead American by negotiating the procedure.

"The balance of convenience as between the parties certainly favors the engineers," Judge Weiss said. "The deductions are made under steps taken by the individual employees in violation of law, not defendant's which is struck."

Judge Weiss was expected to enter a court order under which American would have to maintain the checkoffs by continuing the procedure. American, but still would have to comply with the checkoff order unless the dispute court consented to stay it.

Eastern Completes 727 Jet Financing

New York—Financial arrangements were completed last week by Eastern Air Lines and a syndicate of banks and insurance companies to cover the airline's \$250 million acquisition of 40 Boeing 727 widebody jets (ENR Sept. 2, p. 36).

Refinancing and leasing programs will be supplemented by a \$20 million sale of new stock, giving Eastern a secure fund for other expenses connected with its 727 program.

Classen Machine Bank is the lead institution for banks involved. The insurance companies are Pacific Indemnity Co. of America and the Life Assurance Society of the United States.

Arrangements include an extension of maturity dates on \$170 million of existing debt, and \$67 million in new loans. Of the new money, \$20 million will be held in reserve. The new issue of \$20 million in subordinated notes provides for conversion of the notes into Eastern's common stock at a price yet to be determined.

Eastern will purchase 15 aircraft outright, but will lease the other five from Boeing and the engine manufacturer, Pratt & Whitney Aircraft Corp. With the first 727 delivery to Eastern scheduled for Oct. 32, the airline expects to have five on hand by the end of the year. Initial assets will be used for crew training and route development, as Federal Aviation Agency certification of the 727 will be expected until December.

Pan Am Pilots Polled On Split With ALPA

Washington—Pan American World Airways pilots may be the next large group to break away from the Air Line Pilots Assn., as a result of the formation of the new Allied Pilots Assn. at American Airlines (ENR Aug. 19, p. 41). ALPA members at Pan American are quickly being polled on their past service for a new union, formulated along the lines of Allied with contract provisions comparable to those won at American.

The move was suggested by a veteran Pan American pilot who has resigned from ALPA. Support is being solicited through a series of letters circulated to all ALPA members at the airline. Basic premise is that a new "Pan American Cockpit Union" can accomplish more in direct negotiation with the management than ALPA can with its insurance as a fallback. It issues headquarters policy on crew complement, wages and working conditions.

Proposed emphases these points:

- One, insufficient union is needed to put out, and to accept, a contract.
- Local executive councils of the new union should consist of three members, including a captain, first officer and flight engineer. They should be paid \$50 hr. per month and be paid for 15 hr. with the difference being assumed by the union program.

- Union president should be selected from any category with a pay equal to that of the local executive council's captain, and his flight time should be limited to 15 hr. per month.
- All acquisitions with the airline would be considered by a legal firm specializing in labor relations. The proposal disavowed the usual pilot representation as a case of seeking "inside no fight solution" and stressed that adequate legal counsel could be retained for about \$10,000 per year.

Union leaders would request elected representatives to vote the will of the majority. The proposal charged that there is "very little if any representation in ALPA with local executive chairman often voting in their own pecuniary interest rather than in directed by their council members."

Operational cost of the new union would be about 40% lower than that of ALPA, the proposal charged, with annual dues totaling about \$655,000. Total annual expenses, including the president's salary, along with that of the local executive council members in Frankfurt, Miami, New York, San Francisco and Seattle, would approximate \$175,000. Total salary of the elected president would be \$32,000, with \$15,621 paid by the company under a guarantee of a monthly 15 hr. base pay.

The aircraft was delivered to the airline in October and had recorded 2,225 hr. before its final flight.

To maintain its schedule after the accident, Swissair obtained a Conquest from Scandinavian Airlines System on a temporary lease basis. The aircraft, however, is scheduled to be returned to SAS Sept. 16.

Damaged Gear May Have Ruptured Fuel, Hydraulic Lines on Caravelle

Geneva—Damaged and overinflated landing gear and a ruptured, apparently ruptured hydraulic and fuel lines upon retraction into the wheel well after take-off, is believed to have led to the crash of a Swissair Sud Caravelle 5 near Zurich on Sept. 4 (ENR Sept. 4, p. 51).

Swissair and Federal Air Office officials say the damaged left gear apparently lost upon a number of fuel and hydraulic lines to a ruptured area of the wheel and then set fire to the ruptured fuel. The fire quickly spread across the wing.

With the loss of hydraulic fluid, the pilot probably also lost control of the aircraft, which plowed about vertically into the ground about 18 min. after take-off from Kloten airport, killing all 60 persons aboard. In the crash and ensuing fuel explosion, the aircraft had a crater in the ground about 10 m deep.

Portions of a tail and a melted wheel rim from the aircraft were found on the Kloten runway after the crash, indicating that the brakes had become severely overheated.

The boiler unit, second from the front of the aircraft, was found at the crash scene, is now being tested by the Federal Institute for Materials in Zurich in an effort to determine the maximum temperature reached during the aircraft's short flight.

Prior to take-off, the pilot reportedly had made an unusually long taxi run while waiting for fog conditions to clear at the airport.

Meanwhile, Swissair has ordered as

immediate fix to install a fire warning system in the wheel well units of its remaining seven Caravelles. Such a unit is not included in the standard factory configuration. Work on the Swissair Caravelle is scheduled to be completed by Sept. 28.

The airline also has instructed its Caravelle pilots to use a maximum of braking on all approaches and to deploy the aircraft's drop parachutes when landing weight is above 37 tons or when fuselage length is below 8,300 ft.

Other structural fixes may be made as the repairs. Proposals under discussion include the possibility of either shortening the fuel and hydraulic lines from the landing gear with a steel covering—a retrofit that would require the services of the manufacturer—or applying the light aluminum tubing with steel armor.

Following the crash, the Federal Air Office had considered ordering all Swissair Caravelles grounded but later decided that there was no cause to take this action.

The flight recorder aboard the Caravelle also has been recovered from the crash site, and Swissair officials say that no more indication of any difficulty has been detected thus far.

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Time tells you

The Pratt & Whitney PT-6 turbine engine tells its high performance story in terms of time—thousands of hours of faultless operation. Thoroughly tested and proven to rigid specifications, the low weight, high power PT-6 powers a wide range of rotary and fixed wing aircraft. For these reasons, the PT-6 has been chosen for twelve installations of which seven are presently flying.



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THE EXTRA CARE AIRLINE

FAA Seeks U.S. Short-Haul Transport Aid

Washington — Federal Aviation Agency is asking for President Reagan's support in providing adjustment funds for the development of a U.S. short-haul transport. One idea is to go thru companies \$100,000 each to draft detailed proposal.

The effort received backing at the Senate last week when Sen. Thomas J. McIntire (D-N.H.) introduced a bill expressing congressional endorsement of the project. A similar bill, sponsored by Rep. F. Bradford Morse (R-Mass.), is pending in the House.

Sen. McIntire said "I have been surprised to discover how little attention our domestic manufacturers have been devoting to this concept." He argued that a "small, short-haul, widely serving transport" would enjoy the government's initial involvement with its lower operating costs.

Last year much money the U.S. would provide for short-haul transport development has not been decided. Congressional sources said the idea to give three companies \$100,000 each to design the transport has not yet been decided. While House approval, FAA Administrator N. E. Hollander publicly has not gone beyond declaring that "the FAA is planning to solicit the President's backing for a program to initiate a design competition leading to the availability" of the short-haul aircraft to be used over local service routes.

In a letter to Sen. McIntire, Hollander said that if firm designs, schedules and cost estimates for the short-haul transport become available, he hoped "a limited number of companies would also step forward." FAA studies, Hollander said, to decide local service routes are using aircraft too large for the routes they serve.

New England airlines are eyeing such routes to obtain a short-haul transport because of the uncertain future of Northeast Airlines. Sen. Edward Kennedy (D-Mass.), the President's brother, is among those lighter in continued air transportation to New England (see p. 52).

Civil Aeronautics Board's refusal to approve the purchase of small, short-range helicopters by the local service industry, plus a new plan to make cost-effective costs as the industry's annual subsidy bill, has focused new attention on the need for a DC-3 replacement.

The DC-3's 30-35 passenger capacity long has been considered ideal for the local, but even though fully depreciated and its operational and maintenance costs have become prohibitive. During the past seven years, the industry has sought to re-equip with faster and

larger capacity aircraft including the Martin 202. Current rates \$10 and \$15, and the new helicopter (see p. 27). Each proposal superior to the venerable DC-3 in terms of speed and unit costs, but purchase and depreciation costs reflected most of the anticipated benefits. With its average load factor nearly exceeding 40%, the airlines have been unable to fill the total 40-seat configuration of the new aircraft.

The industry began to search for an other aircraft, looking in mind that in most cases speed is of secondary importance as its predominantly short-haul routes of 75 mi., plus the fact that the average flight loadings approach nearly the DC-3 capacity.

Analysis of the industry's needs as requested by the Assoc. of Local Transport Airlines, and later passed by the CAB and FAA, indicated the need for a new engine, but low-powered transport carrying 18 to 25 passengers 500 mi. without refueling. In particular, the industry wants the aircraft to be economical over the 80-mi. stage lengths that account for as majority of short flights (AW May 20, p. 45). The aircraft should cost no more than \$500,000 and have a high turning potential.

He said the actual design of FAA and CAB participation could be worked out once the manufacturers submitted detailed proposals for the aircraft.

Six Firms to Enter SST Contest

Washington—Three aerospace manufacturers and three engine firms last week, awarded the Federal Aviation Agency, they will participate in the design competition for a supersonic transport, but three major companies declined to take part in the project.

Beeing Co., Lockheed Aircraft Corp. and North American Aviation said they would be contacted in the aircraft design. Powerplant competition are Pratt & Whitney, Flight Propulsion Div. of General Electric Co. and Carter-Wright Corp.

Donald Aircraft Co., General Dynamics Corp. and McDonnell Aircraft Corp. said other commitments stood in the way of accepting major roles in the program. All three indicated, however, they would be willing to undertake substantial work in a limited part in the program.

Deities, for example, and it had decided to concentrate its resources in the commercial aircraft field on the DC-8 and DC-9 transports. It and it would be interested in the supersonic transport on a part venture basis with other companies or as a subcontractor.

Deities had at least one bid with the FAA last week in accordance with

using the industry's average aircraft passenger loading would give the DC-3 passenger load factor averaging about 30%.

Sen. McIntire told the Senate last week that a short-haul transport would be a contribution to air export potential as markets all over the world. The improvement of air service, partial elimination of aviation subsidies, expanded opportunities for the domestic aerospace industry, and a real boost to the less densely settled parts of this country."

Although FAA already can move ahead with such an aircraft, Sen. McIntire argued that his bill would make sure that the FAA administration had "all the authority it will need. The bill also gives Congress the opportunity to participate in this worthwhile development program." He said precedent for the measure is found in the 1950 law in which Congress ordered the development of future-powered transport aircraft. The bill authorizes FAA to draft specifications for such an airplane, provide operational testing, and to help finance development.

He said the actual design of FAA and CAB participation could be worked out once the manufacturers submitted detailed proposals for the aircraft.

The terms of requests for proposals distributed to the industry last month (AW Aug. 18, p. 27). The requests for proposals included a list of requirements of the program and stipulated Jan. 15 as the deadline for the design competition phase.

Industry has been skeptical of its ability to undertake the 75% development costs of the project, as proposed by President Kennedy. However, FAA has pointed out that submission of proposals in the design competition does not commit any manufacturers to the financial terms of the project. Contracts will be awarded in May after an analysis of the proposals.

At present, Boeing and North American jointly hold an FAA study contracts valued at \$1.7 million for various research programs on supersonic transport materials and structures.

But Boeing has no plans to coordinate with North American in its bid for the project contract.

A Lockheed spokesman said that while a joint effort with another manufacturer might develop later, the company is planning to undertake the program initially as the single prime engine contractor.



"Air Express saves us a week in fashion-trend spotting—and that can mean success or failure to us!"

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Air Express helps Leslie Fay move as fast as a woman's mind changes.

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Air Express also helps Leslie Fay deliver dresses for store fashion shows, ad preparation and sudden demands. "It builds goodwill to use the fastest shipping method." "You can do the same."



FAA Studies Crew Service Revisions

Washington—Federal Aviation Agency is exploring the possibility of introducing major revisions in rules governing minimum hours of service for airline crews. In selecting suitable revisions on the proposed changes, FAA is supplementing these points:

- Use of standby time together with flight time to determine minimum hours of service crew members should operate. Present time limitations on scheduled airline operations apply only to flight time without considering the amount of standby time that is necessary to prepare for flight time.
 - FAA wants clearer and more specific requirements for rest periods. Current rules do not prescribe duty rest periods for flight crews as long as they do not exceed specified flight duty in any 24 hr. period. On the other hand, according to the FAA, rules allow excess rest periods which may not be necessary.
 - Flight time rules should be extended to include pilot attendants. FAA reasons that while other attendants are not engaged in the actual operation of aircraft, they are responsible for performing certain emergency duties which "must be executed with a high degree of skill and competence." FAA holds that rules should be adopted to prevent accidents and disturbances from becoming overly frequent.
 - Specific maximum rate limits of daily flight operations should be assessed. FAA said that under existing conditions, a single flight crew may be engaged in domestic operations for 8 hr. of flight duty without an intervening rest period, while a flight crew in international operations may be scheduled for as long as 12 hr. FAA said that such differences do not appear to be justified upon the present operations.
- FAA has found that flight time rules have been subject to numerous interpretations. The agency said that as a result, varying standards may be "unreasonably stringent" or "too broad to be effective in preserving crew fatigue."

All-Cargo Air Carriers Ask CAB To Ease Competition From Trunks

Washington—Billed with competition of both airlines and airlines on cargo operations is being sought in three all-cargo carriers that face the prospect of a sharp drop in Military Air Transport Service contracts.

Stark, Aswell, a Redline Airlines and the Flying Tiger Line made the request proposal to the Civil Aeronautics Board. They warned that an expected cutback in MATS business will mean "serious death" to their airline companies.

They also stated the present volume of competition in the cargo field. When carriers are highlighted by the U. S. Air Force, order for 132 C-141 Starliner airplanes, the first shipment of which will be delivered to MATS in June 1967 (AV Aug. 26, p. 34).

Most threat of their argument for reduced competition is that major trunks have been losing money on cargo contracts for several years and subsidizing their losses through passenger revenues. American, United, Trans World and Eastern, which have major competitive with the all-cargo airlines, last year lost a total of \$11 million in cargo operations, they pointed out.

Such losses are inequitable, they said and have been caused by an excess capacity problem created by the trunks, which are willing to suffer losses in order to defeat the Board's decision to establish a "specialized" all-cargo industry. Stark and Flying Tiger were

awarded prominent all-cargo, cost-cutting rates by the Board last year. Redline has a reputation with such certificate.

Trunk, carrying all cargo should be limited to "bulk cargo," with all bulk freight relegated to the all-cargo operations, the proposal stated. Trunks requesting more capacity for large shipments could purchase it at a moderate price from the all-cargo airlines and resell it to the shippers.

As a matter of public policy, the proposal stated, the CAB should hold an investigation to study the proper roles of the all-cargo and passenger carriers in this market.

- Set forth the detailed functions of each carrier, specifying limits to indicate when they are to be used for.
- Designate all-cargo carriers as the sole bulk freight carriers and wholesalers of all cargo services. Having the trunks with cargo carried only as passenger attendants.
- Urge the Post Office to experiment with free movement and work with rates for the carriage of bulk mail from post office to post office.
- Urge the Post Office to change the allocation rules for first-class mail to set toward rather than away from the governing criteria.
- Establish a policy so that Defense Dept. air cargo traffic is handled by all-cargo carriers. This provision would apply to Logue, Quicktrans and MATS cargo.

AIRLINE OBSERVER

► Federal Aviation Agency's deauthorization program appears to be working in reverse and has been tabbed by industry as the "deauthorization program." Even as the agency plans to ax about 600 Washington personnel into the field, it has quietly closed its altitude advisory service maintained for the Strategic Air Command at Kansas City, Mo. As a result, about 90 FAA personnel will be transferred into Washington from the advisory center.

► Sen. Edward M. Kennedy (D-Mass.) courted new pressure last week for legislation that would override the Civil Aeronautics Board decision to withdraw Northeast Airlines from the New York-Florida route (AW Sept. 9, p. 41). Armed with petitions protesting the Board decision, which here gave 300,000 signatures collected by Northeast Airlines, Sen. Kennedy again pledged to continue to fight for the route. Little congressional interest in Kennedy's drive has been noted, except in the New England delegate times, suggesting that the legislation has a slim chance of being passed.

► Flying Tiger Line and New York Central Railroad have signed a joint rail freight agreement that will permit shippers to use facilities at both centers under a single bill of lading as though they were dealing with a single transportation company. The service will be available to 57 communities in the Albany-Troy-Schenectady area served by New York Central and 238 West Coast cities that are covered by Flying Tiger Line and connecting truck carriers.

► Soviet efforts to improve Aeroflot's overall payload factor by boosting around volume are showing average results for the second straight year. In the Russian Republic, which has more than half of the USSR's population and over 75% of its area, Aeroflot's mail tonnage during the first half of 1985 was up only 5% over the same period last year. This compares with a reported 8.5% growth in the Russian Republic's overall industrial output in the same period.

► CAB staff's drive has a damper of markets for U.S. carriers on international routes (AW Aug. 5, p. 41) as well since government opposition last week. In a New York speech, G. Griffith Johnson, assistant secretary of state for economic affairs, said, "The President's statement [looks] on international air transportation] gives us color of support for the demand of markets or the interference or interference and arrangements in aviation policy affect only in aviation. Our staff... does not just beyond our own citizens and our own bilateral agreements."

► British Overseas Airways Corp. has initiated the first transatlantic electronic reservations system between the U.S. and Europe. European carrier reservations staff in New York to query a center computer in London, which can handle up to 5,000 queries an hour, an available route on BOAC flights throughout the world.

► Hungarian is planning to build a large heliport at the underdeveloped Budaörs Airport just south of Budapest, which handles flights from the Soviet Union, Belgium, Romania, Czechoslovakia and Yugoslavia. Russian-built transport helicopter will fly passengers to downtown Budapest and other points.

► United Air Lines President W. A. Patterson last week gave his views on the importance transport. Patterson said he felt United had a "primary level line. It is not just flying and be ready for some economic." He said it was too early to reach final decisions, but that "it is never too early to analyze the problem that 883 will create as far as route situation is concerned..." He implied that United is not yet ready to order a supersonic transport, and that those carriers which are "prepared" to lose selected the Concorde have done so in a protective measure at little risk to themselves.

SHORTLINES

► Aeroflot claims to have carried a half-million passengers on its route between Baku and the off-shore Caspian Sea oil center of Nefteba, Koms 100 Backs) during the past three years. Eleven-passenger Mil Mi-6 helicopters cover the 60 mi route at about 17 mph, compared with 6-7 hr by boat.

► Air Freight Forwarders Ass'n's first trade program, made was approved by the Civil Aeronautics Board last week. Chief purpose of the code is to coordinate the use of order tariffs and interconnections that would decrease the public.

► British European Airways paid \$10.4 million in commissions to travel agents and other airlines during the first year ending May 31. Passenger revenues for the period totaled \$119.7 million, 60% of which was generated by travel agents.

► CAB has proposed a rule requiring that passenger status and addresses appear on all manifests of charter flights. Purpose is to and CAB's bureau of an enforcement in the location of passengers for determining to determine that after flights meet all regulation requirements.

► Federal Aviation Agency has approved a 400 lb increase in the payload of the Sikorsky S-63 helicopter. With certified gross weight a new 7,000 lb, with approval to operate at 8,000 lb on special projects such as personnel evacuation or other cargo sling operations.

► Iberia Air Lines of Spain will expand its transatlantic flights to Madrid to a total of seven weekly beginning Nov. 1. At present, no flights are scheduled.

► United Air Lines has signed an interline agreement with Russian National Airlines, making it possible for a single ticket to cover transportation over routes of both carriers.

► Western Air Lines cleared a \$1,000,000 net profit for July, the first month at the carrier's bottom that profits have passed the \$1 million mark. Previous record was \$341,000, reported in June of the year.

► "Vier U. S. A." trail has been approved by CAB. It permits foreign carriers to fly on all routes of all four U.S. carriers but Texas Texas Airlines and an Alaska Airlines for a period of 25 days at \$100 per person or 45 days for \$200. A 50% discount is allowed for persons under 21 accompanied by parents.



Tough guy

The toughest power plant for any aero-engine is its tractor variant, where the Bristol Siddeley Viper gas turbine made its reputation. In seven years Viper-powered trainers have entered service in six Air Forces of the world. Add to this the fact that Vipers have also featured in nine other types of aircraft including executive, research aircraft and fighters and you have solid proof of ruggedness and reliability.

The sheer simplicity of the Bristol Siddeley Viper is the basic reason for its reliability and ease of handling. It has also been a major feature in the rapid development of the engine from its original rating of 1,770 lb. The latest version, the Viper 30, is rated at 2,000 lb thrust and

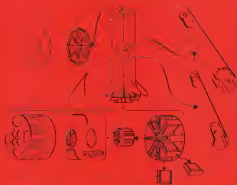
powers the Hawker Siddeley 125 and the Pucara/Douglas PD-408 executive jets. The engine is now under development to even higher thrusts.

An extensive service organization exists for the benefit of the operators of Bristol Siddeley engines and full servicing facilities are available throughout the Americas.

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BRISTOL SIDDELEY SUPPLY THE POWER



EXPLODED VIEW OF SATURN S-1 BOOSTER production steps shows 108 in dia., liquid oxygen tank centered among eight others.

NASA, Chrysler Trimming Weight of S-1

By George Alexander

Midland, East-Chrysler Corp. and the National Aeronautics and Space Administration are trimming more than 15,000 lb from the Saturn S-1 booster in redesigning the unit as the first stage of both Saturn I and IB launch vehicle configurations.

In evaluating Chrysler's contract, NASA's Marshall Space Flight Center checked that both the original S-1 and the new S-1B version were to be built on the same production line with only minor changes to the tooling making it useful at the NASA-owned plant. Members of the two models will be so close that they will be interchangeable in the future, when the last S-1 is completed, to maintain maximum space flight schedule.

Marshall does not plan to order more S-1 stages after S-1-116, the last presently planned operational unit of

the booster. The center, however, probably will continue to fly Saturn I launch vehicles for many years to come. It is expected that the center will substitute the S-1B for the S-1 in the Saturn I configuration and when the S-1B second stage is a third-of-way step.

An S-1B S-4 launch vehicle could carry at least 2,800 lb more into earth orbit than an S-1 S-4 configuration. This new booster growth will be coupled with two other interstage alterations, one for S-4 and the other for S-4B second stages.

Redesign of the S-1 stage into the S-1B growth is an exercise in weight subtraction. In the substitution of various Marshall officials at different times in the past, the original S-1 stage was conservatively designed and as a consequence, now is heavier than required. When the first flight of the stage suggested this conservative design, Marshall decided that some weight could be

shed from the unit with safety and still preserve payload capacity. It has been estimated, according to Chrysler Space, the engineers that every pound gained from the S-1 booster will yield an additional 0.15 lb for the payload. The 18,000 lb to be removed from the S-1, therefore, will provide an extra 2,700 lb for the Apollo space suit to use in earth orbit missions.

Late last autumn, Marshall and Chrysler advised, rather than the S-1 would be redesigned for the S-1B configuration and told the company not to plan beyond eight Block 2 units of the S-1. In February, Marshall sent a request for proposal to Chrysler and identified three areas, including substructure, where it was to reduce weight. Structure was to be reduced by 10 to 15 lb. This included replacement of seven of the Block 2 S-1's eight feet (one foot was to be left as it was) for a proposed saving of 2,300 lb, elimination of the



TAIL SECTION INCLUDING THRUST STRUCTURE of S-1 booster S-1-83 is positioned on assembly floor. S-1-6 is in background.



SPIDER BEAM ASSEMBLY IS JOINED TO FORWARD END of the S-1B's shell. Liquid oxygen tank (above, left and right) is assembly of Saturn S-1 booster, designated S-1-10 by NASA's Marshall plant. Center 108 in dia. tank is first of nine to be attached to the thrust structure (below) in booster S-1-2 seven complete in part currently being. Chrysler Corp. and NASA are trimming more than 15,000 lb from the S-1B S-1 booster. Future versions will have S-1B in first stage being more production than with less changes.





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S-4's liquid oxygen tank and supports for 715 lb. cooling of the thrust bearing test section for 1,747 lb. m-drag, of the engine compartment heat shield, reduction of external drag on the propellant tanks for 1,915 lb. and trimming and cleanup of the eight tapered upper beam assembly for 1,673 lb.

• **Propellant** system was to be trimmed by 1,115 lb. This included 540 lb. loss of thermal protection on the fins, around the engines and other heat-affected areas, elimination of the 960 lb. liquid oxygen-weld oxygen (known as LOX-WO) disposal system, and transfer of eight gaseous oxygen check valves from the booster to ground support equipment.

In the last step, Marshall also directed Chrysler to lower the parasitism level on the five liquid oxygen tanks from fill post to 46 post to save 561 lb. to substitute helium for nitrogen in pressurizing the first fuel tanks and save 540 lb. and to eliminate the gaseous nitrogen pressurizing system which drove the LOX-WO system and thereby pick up another 174 lb.

These last three items, amounting to 1,071 lb., are not deductible from the dry weight of the S-1 since they are not added until the time of launch. At time of thrust decay, however, the overall Saturn IB would see a eight difference between two different parasitism loads in its tanks.

• **Instrumentation** system was to be reduced by 1,740 lb. largely as a result of the vehicle's status changing from research and development to operational. It therefore no longer required the same degree of performance redundancy. Savings were expected to come from elimination of the motor and television camera (3,115 lb.) and reduction of wiring and electrical systems by 7,27 lb.

Although Marshall had initially only planned to cut about 15,250 lb. from the S-1, it soon became apparent to both the center and Chrysler, as they delved into the fine details of the stage, that even larger savings were possible.

Chrysler studied every square inch of the S-1 and suggested further cuts, most of which were approved by the NASA center in a series of re-design reviews.

Using this target weight as the bid request as a guideline, Chrysler went to work. The center did not stipulate the way and means of cuts out, leaving some discretion to Chrysler. Marshall did reserve the right to review such suggested reductions before authorizing a change.

Chrysler first looked at the engine compartment heat shield and the forward upper beam assembly. The shield is made of expanded corrugated steel on a steel rib as the original S-1 design. It will be replaced by a bonded stainless

steel honeycomb filled with a NASA-developed ceramic mounted on the heat-treating side and backed by a second steel honeycomb layer on the back side.

The new shield is expected to save at least 551 lb. over the original design. In the upper beam area, which is under the eight-legged beam assembly, a covering steel plate and 45-deg flange ring auto-weld mounting and caps, Marshall had hoped to save 1,673 lb. following the center's instructions. Chrysler will clip 25 in off the end of each of the eight beams and shave between A and E in from the flanges and heels of the guide—which are 7071 aluminum 3-beams.

The savings are expected to total more than 1,900 lb.

Sail Plans

The steel plate atop the guide beam, designed to prevent loads from the air and stage dropping on the boosters, will be changed from eight two-piece girders to eight single girders. This difference is expected to be about 250 lb.

A 45-deg flange, which had smoothed the 217-in dia surface of the S-1 booster into the 218-in dia bore of the S-4 second stage, will be completely eliminated for a saving of about 1,300 lb., or more than 500 lb. above the figure Marshall had estimated.

The lining will not be repeated with the 268 in dia S-4B stage.

Marshall told Chrysler to move the 510 wire racks, their supports and casings, from the ends of the eight-legged upper beams to the interstage adapter. This adapter is the responsibility of, and its weight is charged to, Douglas Aircraft Co.'s second-stage (S-4B) manufacturer.

Total weight of all retro-rockets associated hardware is about 1,680 lb.

Chrysler expects a saving of about 4,000 lb. from the upper beam areas. At the S-1, the figure is about 50 lb. greater than the initial estimate of 1,673 lb.

Largest weight saving will come from a re-design of the auto-actuator fan around the base of the S-1 booster. The first of the Block-2 boosters, SA-6, is scheduled to be launched from Cape Canaveral later this year and will serve stabilizing fins.

Dyna-Sear Use

Four of the fins are about 128 sq ft each and four are 100 sq ft each. The fan was incorporated into the design of Saturn's central vent area when it appeared that USAF might use a Saturn I vehicle for its Dyna-Sear program.

They were deleted after USAF decided on the Titan 3 vehicle for the program, except spacers which will be of the Saturn I, but were retained to the



HEAT LOGGED UPPER BEAM ASSEMBLY (above) is checked for alignment after work begins on Saturn S-1 production line at Marshall plant. Assembly is shown mounted from several positions. Aerial from Saturn field 20 in dia gas spacers.



BEARS AND OUTSIDER of third structure recently are posed on a jig (above). Bore of idea float of fins around H-1 engine. Also shown is the outer shell of the H-1. Completed third structure (below) shows eight corrugated and outer barrel. Structure is positioned on one of two present booster assembly fixtures. Fine call for addition of a third at Marshall. NASA plans to use next production facilities for future Saturn.





Motion study. Induced rotation of a Manned Orbital Research Laboratory under study by NASA, which would provide artificial gravity for its crew, could also introduce unwelcome twist, tumble, spin and wobble in space. □ Because these motions can best be arrested by precision stabilizations, Sperry is under contract to NASA Langley Research Center to make dynamic analyses of the types of motion which may be encountered; to derive control laws which may be applied to the resultant problems; to generate control concepts which will guarantee station stability. □ Because orbital times up to a year are under study, a manned station presents a unique challenge in control. Sperry experience in gyroscopes, aerospace control, attitude stabilization logically suits us for the task. General Offices: Great Neck, New York.

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designs later for stabilizers. On the Block 3, each of the five sets of conventional spin-stabilized aircraft construction. On the S-18, all eight of which will be about 55 sq ft each, a clear box will replace these ribs and struts.

The box, which is 50 lb lighter than the built-down strut in the original design, is expected to be adequate to restrain the vehicle for three seconds at the moment of launch when the eight H-1 engines are run up to full power before commitment to flight. The halves of the 110-in.-span, 41 deg swept fin—beyond the built-down point, which is 37 in. out from the side of the booster—is externally supplied and lightweight.

Further adding to the weight reduction of the redesigned fin is the complete elimination of three 52 ft long liquid hydrogen vent lines. The starting sequence of the Pratt & Whitney RL-10 engines in the S-1 second stage requires a flow of both liquid oxygen and liquid hydrogen in the injector domain of each of the six engines prior to ignition. The liquid oxygen shut-down line is disposed of through the LOX-SEN system.

Hydrogen leaves the domain through special shut-down side valves so as to preclude mixing with the liquid oxygen before ignition is planned, and ducted through three 53 ft lines down along the outside of the S-1 booster and dumped overboard from the base of the first stage.

These lines run into three of the four stack fins of the Block 3 S-1s, where they are ignited and approximately 30 deg from the vehicle's centerline. This ignites the gas into the hot ex-

haust of the engines. The first set of conventional spin-stabilized aircraft construction. On the S-18, all eight of which will be about 55 sq ft each, a clear box will replace these ribs and struts. The box, which is 50 lb lighter than the built-down strut in the original design, is expected to be adequate to restrain the vehicle for three seconds at the moment of launch when the eight H-1 engines are run up to full power before commitment to flight. The halves of the 110-in.-span, 41 deg swept fin—beyond the built-down point, which is 37 in. out from the side of the booster—is externally supplied and lightweight. Further adding to the weight reduction of the redesigned fin is the complete elimination of three 52 ft long liquid hydrogen vent lines. The starting sequence of the Pratt & Whitney RL-10 engines in the S-1 second stage requires a flow of both liquid oxygen and liquid hydrogen in the injector domain of each of the six engines prior to ignition. The liquid oxygen shut-down line is disposed of through the LOX-SEN system. Hydrogen leaves the domain through special shut-down side valves so as to preclude mixing with the liquid oxygen before ignition is planned, and ducted through three 53 ft lines down along the outside of the S-1 booster and dumped overboard from the base of the first stage. These lines run into three of the four stack fins of the Block 3 S-1s, where they are ignited and approximately 30 deg from the vehicle's centerline. This ignites the gas into the hot ex-



haust of the engines.

Use of lightweight fins, incorporating shear boxes and elimination of the liquid hydrogen vent lines are expected to add up to a weight saving of about 6,000 lb, compared with the original estimate of 2,500 lb. In the original esti-

mation, the fins would have been clamped with slugs from the upper stack tips of the Block 2 S-1s.

Then, the decision to proceed with a shear box type amounted to a significant weight reduction.

As the tail section, where the first

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Saturn Designations Changed by Marshall

Midland 1A—Designation of the current Saturn launch vehicle and stages were rearranged earlier this year by NASA's Marshall Space Flight Center. Without any indication of how long these designations will remain valid, they are as present:

• **Saturn 1.** Smallest and smallest of the three Saturns, the 1 has two versions—Block 1 and Block 2. Block 1, solidly proven and development vehicle, has a five S-1 booster and dummy S-4 and S-8 upper stages. Block 2, which will replace both S-1B and S-1C, consists of an S-1 booster and an S-4 second stage. Its payload capacity is 20,000 lb in earth orbit.

• **Saturn 1B.** The intermediate Saturn, the vehicle consists of the S-1B booster (one stage) and S-4B second stage. Payload capacity is 32,500 lb in earth orbit.

• **Saturn 5.** Largest and the only three-stage vehicle presently proposed by NASA, the 5 consists of an S-1C booster, S-2 second stage and S-4B third stage. Payload capacity is 740,000 lb in earth orbit and 90,000 lb in lunar orbit.

The stages and their nomenclature are:

• **Block 1.** Like the launch vehicle of which it is the booster, the S-1, carries in two versions—Block 1 and Block 2. Only four Block 1 stages are being and have developed. S-1, 1, 2, 3, and 4, respectively, indicate their research and development character, were flown on short ballistic flights from Cape Canaveral on Oct. 27, 1955, Apr. 25, 1967, Nov. 16, 1967 and Mar. 35, 1968. The eight Block 2 stages are being proposed. Block 1 carries more than 115,000 lb of thrust each—no stage thrust of 132,000 lb. Block 2 S-1 stages will be the booster of the operational Saturn 1 launch vehicle. They carry the reported 10.3 of 330,000 lb. Block 2 has a stage thrust of 1.3 million lb with a load of 250,000 lb of propellant. Block 2 with over 130,000 lb more lift and liquid oxygen than Block 1s. They also include stabilizing fins around the hot tail. There will be an research and development Block 2 S-1, S-4S through S-8S, and an operational S-1, S-1B through S-1B. Chrysler is building two of the research boosters, S-4S and S-4S, and all of the operational ones. Marshall has about finished building the first of its right R&D boosters.

• **Block 1B.** Basically, the 1B is a lightweight version of the Block 2 S-1 with a dry weight of about 90,000 lb, compared with the 105,000 lb. Block 1s. Chrysler will build 12 S-1B boosters under contract. The first two boosters are scheduled contracts and development flight 1B stages are the first operational stages. 1B stages are designated S-1B-201 through S-1B-210. All S-1B-Block 1, Block 1 and -20 are 217-in in dia and stand about 32 ft tall. Block 2 and -20 stages, however, lack the 6-in long forward skirt of Block 1 boosters and have tanks on trapezoidal cross-sections. That accounts for their greater propellant capacities. 1B's have eight side fins of the same size as aerodynamic stability, while Block 1 boosters have four large and four fine fins.

• **Block 5B.** Largest single stage in NASA's inventory, the

Block 5B is the booster for the three stage Saturn 5 launch vehicle. It has a diameter of 35 ft, stands 134 ft tall, has a dry weight of about 200,000 lb and a fully fueled weight of about 4.6 million lb. It is powered by five Rocketdyne F-1 engines rated at 1.4 million lb thrust each—stage thrust of 7.1 million lb. Marshall will build three test units—1C-1 (static test), S-2C-1 (dynamic test) and S-1C-1 (dynamic test)—will be the first flight boosters, S-2C-1. Boeing will manufacture (AW Aug. 17, 1962, p. 51) one ground test unit, S-2C-2 (flexible checkout) and one flight booster, beginning with S-1C-2.

• **North American Aviation, Inc., S-2.** Second stage of the Saturn 5 launch vehicle, the S-2 stands about 32 ft tall, 35 ft in dia, and is powered by five Rocketdyne F-1 engines of 700,000 lb thrust each, giving a stage thrust of 1 million lb. Its propellants are liquid hydrogen and liquid oxygen. North American Space and Industrial Systems Div. will build 10 flight S-2s, plus several ground test stages.

• **Danahy S-4 and S-8.** S-4 is the second stage of the Saturn 1 launch vehicle. Powered by six Pratt & Whitney RL-10 engines of 15,000 lb thrust each, the S-4 has a total thrust of 90,000 lb. It is 22-1/2 ft in dia and 40 ft tall. It weighs about 31,000 lb dry and 111,000 lb full loaded. Like all Saturn upper stages it uses liquid hydrogen and liquid oxygen. The S-4 is a big booster in every respect—it is 26-in in dia, 44 ft long, has over 230,000 lb of hydrogen and oxygen and is powered by a single F-2 engine for a stage thrust of 200,000 lb.

The 4B will be the booster of the Saturn 5 launch vehicle and the second stage of the Saturn 1B. Danahy will build one flight S-4 and four ground test variants of its smaller stage. It presently is contracted to build 14 S-4s, although the figure is likely to be increased, considering the fact that there are 10 Saturn 5 and 12 Saturn 1B launch vehicles planned, for a total possible S-4B requirement of 23 stages.

S-5 is the Cassini stage and might become one in the third stage of either the Saturn 1 or 1B launch vehicle. There once was an S-5 stage, but it never progressed beyond a paper study at the Marshall Center.

This stage, which would have been powered by two F-2 engines, was considered several years ago when Marshall planned a two-stage S-1 vehicle consisting of an S-4 booster and S-2, S-5, S-4 and S-5 upper stages. It has been the center's practice to discard a designation along with a repeated stage in launch vehicle studies, rather than the other way around. The stage in the next stage in launch vehicle. This also avoids the pitfall of inadvertently among the discarded stage's documents with the approved stage's paperwork.

Thus, the S-4 did not become the S-5 when it was dropped, although it did end up becoming the second stage of the Saturn 1. Similarly, the Saturn 5 is the fifth launch vehicle configuration considered by Marshall, although it was the first vehicle approved by NASA after the Saturn 1. The Saturn 1B program was approved after the S-1's approval.

of the eight Rocketdyne F-1 engines is transferred to the five three-beeing liquid oxygen tanks. Chrysler will conduct in a space utilization campaign to reduce weight. Overall, the company will achieve an average of 15% off the empty weight, stage plates, rings and flange rings in this manner structurally necessary to make a weight saving of about 2,100 lb.

The initial estimate was 1,747 lb. The three-stage version of a heavy cylindrical center section, called the barrel, eight tapered box, outer,

called outriggers, and top-and-bottom heavy thrust rings.

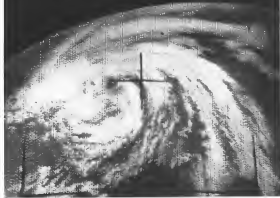
Gas turbines of the five outer tank and four tail tanks also will be added in the experimental design at the forward and rear ends of the cylinder. Marshall had thought it would be possible to shave 1,915 lb from the tanks, but Chrysler presently estimates that a total of only 1,672 lb can be saved.

Both the center and the contractor are still working on the re-design of the

tanks, but they are considering entering the permanent internal volume of the tanks, where the propellants are stored, to look for further weight savings.

LOX-80X is the earliest part of the RL-10 engine chain development. Recently, it consists of a series of high-pressure nitrogen gas pipelines and a series of manifolds in the outriggers space between S-1 and S-4. Gaseous nitrogen purges the manifolds, which are positioned beneath the bell section of each

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of the SL-10 engine, to flush all explosive contaminants. The chief down sequence flow begins with LOX flowing through the injection into the engine and passing into the manifold.

As the LOX expands into the sealed atmosphere at which this operation occurs—about 90,000 m. above—it causes a solid rocket engine (SRO). Nitrogen is used to dump this oxygen even though the storage structure. From the 1.2 engine in the S-10 stage, about 100,000 m. above, the LOX-SRO system, along with the liquid hydrogen vent line, can be discarded. LOX-SRO weighs 1,800 lb.

Research and development with aerodynamic systems and associated closed power systems, will be reduced in three steps. Only 55 lb of armor will be dropped from the first two S-10 vehicles, as they are considered to be light test articles. The next two S-10 launches, the B-10 units, will discard an additional 4,400 lb of instruments and armor.

The first of the operational S-10s, S-10-205, will add still another 1,200 lb of instrumentation. All tested, Chrysler will eliminate nearly 3,400 lb of monitoring and measuring systems. The original system weight estimate was 3,500 lb.

Reduction of gas pressurization levels in both the liquid oxygen and RP-1 tanks will not be counted against the dry weight reduction of the S-1, since

these tanks are not pressurized until there is a full load of propellant aboard, shortly before launch time. The difference in pressure levels, however, amounts to another 1,075 lb less weight for the booster in lift.

All together, the estimated reduction amount to slightly more than 15,000 lb. Chrysler will enter the reduction in three incremental steps, beginning with slightly more than 12,000 lb to be taken from the first two S-10s, about 17,500 lb from the third and fourth flight launches, and finally achieving the 15,000 lb goal by the flight of the first operational S-10.

Chrysler project engineers are now general agreement that they and their Marshall counterparts are taking every precaution to assure that the likelihood of the S-10 booster is not prejudiced by the weight reduction program.

Scram 10 launch vehicles will be used in the 1960-1967 period to fly Apollo approach to earth orbit training missions. Apollo will consist of command, service and lunar excursion modules, with a minor amount of propellant in the latter two.

The three-man crew will pursue routine non-armed and lunar orbit missions. It is expected that the command and service modules will have been fully proven aboard the Scram 1 launch vehicle by the time the Scram 10 enters operation.

Ames Seeking Industry Analysis Of Mars Mission Heat Shielding

Los Angeles—Heat shield requirements for a manned Mars landing and return mission will be analyzed by industry (see NASSI) Ames Research Center for. Proposals for the research study of flight parameters will be submitted today by industry contractors. Contract is expected to be a fixed-price arrangement, with or without incentive provisions, not exceeding \$50,000.

Purpose of the study is to determine shield weight requirements for manned vehicles entering the Mars and earth atmospheres at hypersonic speeds and to improve technical problem areas.

The manned planetary exploration of Mars is considered to be the logical step beyond Project Apollo, and has a maximum objective of landing man on the planet and safely returning him to earth. The higher entry speeds associated with the mission will require a greater heat absorption or heat dissipation capability for the shield. In addition, the increased altitude and heating is also expected to complicate the definition of the thermal/chemical

environment in which the shield will operate.

Re-entry configurations and vehicle shapes to be considered in the study include:

- Current Apollo shape with a lift to drag ratio of 0.5, and an entry velocity of 35,000-45,000 ft/s
- Ames M-2, with a lift/drag ratio of 0.5, and an entry velocity 35,000-45,000 ft/s
- Ames M-3, with a lift/drag ratio of 1.0, and an entry velocity of 35,000-45,000 ft/s

Vehicle weight for these configurations will range from 5,000-15,000 lb and vehicle volume from 500 to 1,500 cu ft. The lift-to-drag ratio variation will be accomplished through self-inflation. For both earth and Mars, entry range requirements will not exceed 100 miles with a 10g (earth) maximum limit on both overpressure and underpressure boundaries. Calculations will be based on entry conditions equal to or exceeding 10 g.

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This application is relatively simple. A powerful magnet in the Chip Detector attracts any foreign particles in the lubricant. These particles bridge the already existing electrical gap, completing a circuit which activates a light on the in-plant panel or can be ground checked with a continuity tester. No tie to wiring and application data.



SEEK INFORMATION, CLIPPING, TIME

Main entry is the current Apollo shape of this standard for lift/drop ratios of 0.3 and 0.5. Vehicle weight will range from 75,000 to 70,000 lb and vehicle velocities will range from 1,000 to 2,500 in/s.

Another large entry vehicle of air train shape also will be considered for the Main entry, capable of producing a lift/drop ratio of 0.1 and having a weight of 500,000 lb and a volume of 150,000 cu ft, with a maximum diameter of 50 ft.

Entry velocity range for all Main entry vehicles will be from 35,000 to 40,000 ft/s.

Associated thermal environment will be calculated for a sufficient number of entry conditions to establish parametric variations.

Effect of vibration mass loss on the trajectory will be considered.

Flow field and heat transfer distributions about the entry vehicles will be

determined. Calculations will include convective and radiative heat transfer for both the entry blouses and non entry blouses conditions. Non equilibrium dissociation and ionization, and energy transfer along streamlines due to collision and absorption, will be considered. A standard material analysis will include phenolic resin in equal proportions as a reference material. Possible trends in development of new heat shield material for the heating environment also will be indicated.

Analysis of heat shield conditions also will include determination of amount of ablative material required, the amount ablated, depth of degradation, and temperature distribution in the shield.

Backflow temperature consistent with current state-of-the-art boundary temperature will be used. Effects of increases in boundary temperature also will be considered.

Advanced Vehicle Crew Station Proposals

San Angeles—Proposals for design efforts to be used in development of optimum crew stations for advanced aerospace vehicles are being conducted by USAF's Aeronautical Systems Div. GAN-Ang-5, a DDC. Contract award for the 10-month study is expected to be made for the end of October.

Three studies of complete vehicle and associated design parameters to be considered in the analysis, are:

Parameter	Low Earth-Orbital	High Earth-Orbital	High Earth-Orbital Re-Entrant
Possible mission	Personnel rescue, satellite inspection	Transport-supply, retrieval	Rescue, reconnaissance & control
Crew	2 days 3 days	3 crew + 3 pararescuers	21
Altitude duration	2 days	30 days	30 days
Basic configuration	Winged	Lifting body	Torus control decking
Launch	Vertically launched	Horizontal at 15,000 feet alt.	Space-to-land, 10,000 feet alt.
Re-entry orbit alt.	200 feet alt.	40 deg.	40 deg.
Orbital inclination	20 deg.	20 deg.	6 to 10
Re-entry environment	Zero-g	Zero-g	Free-fall
Re-entry man	Active	Active	Passive
Re-entry	Yes	Yes	Yes
Crew & equipment	Yes	Yes	Yes
Recovery	Landing, controlled	Landing, controlled	Not applicable
Recovery velocity	25,000 ft/s	25,000 ft/s	Not applicable
Landing	Controlled, bungee	Controlled, bungee	Not applicable

Phase 1 of the program will be an investigation of basic crew station design concepts and environment for configuration, mission, crew function and environment.

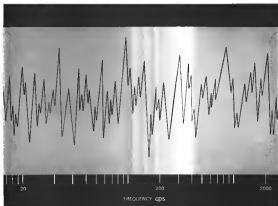
Phase 2 based on results of Phase 1, will include recommendations for design efforts related to habitat, device and personnel, which might encompass multiple, multiple locations, etc. It will also include a list of requirements and procedures which may be considered in a comparative study of facilities in existing and on orbit.

These facilities include the General Systems/General C-121 aircraft with a capacity of 15-18 by 4-4 by 8 ft, prototype and a 20-ft. Redwood, and the Viking KC-135 with a capacity of 45-60 by 7-8 by 6-6 ft prototype and a 45-ft. Redwood. General Systems, Aerospace Division for the C-121 and KC-135 are 15 cos. and 20 cos., respectively.



VIBRATION NEWS

MB ELECTRONICS • A DIVISION OF TETRAON ELECTRONICS, INC.
Representatives in principal cities throughout the world



MB introduces SWEEP RANDOM— a new, low-cost method of random vibration testing

MB Electronics now offers industry the Narrow Band Sweep Random system. This new technique in random vibration testing is designed to create a linear and acceleration at all levels similar to those provided in the more expensive wide band random test. It is easy to operate and inexpensive enough to be used with the smallest shaker test system in general use today.

Thenew MB SWEEP RANDOM test bed reduces the total force required for wide band testing by sweeping slowly over the frequency range with an intense narrow band excitation, in contrast to the low acceleration density excitation of the wide band test. This results in a reduction of force one third to one half the force ratings heretofore required for simulated random vibration tests. Con-

siderable cost savings are also realized with this new MB system.

The MB Sweep Random system is readily varied for test components and sub-assemblies of systems which might be given a final qualification test by wide band random techniques.

For more detailed information on the Sweep Random system write to MB Electronics, 781 Whalley Ave., New Haven 3, Conn.

How Goodyear "Engineered Value" solves today's flight problems

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FOR THE NAVY

FOR PRIVATE FLYING

FOR THE MARINES



PROBLEM: Re-entry heat of wheels, brakes and tires.
SOLUTION: Goodyear wear tires and skids.

ADVANTAGES: Withstands prolonged exposure at re-entry temperatures. Shortest roll-out of friction of any skid system. Shorter landing runs. Gives "bounce" aircraft landing capability.



PROBLEM: Wheel corrosion in naval aircraft.
SOLUTION: Goodyear plastic wheels.

ADVANTAGES: Unaffected by marine environment. Requires no painting. Conforms with metal wheels in areas of weight and cost. Standard inspection techniques. Helps protect tires from brake heat.



PROBLEM: Icing conditions.
SOLUTION: Goodyear fogaid.

ADVANTAGES: Reliable—no moving parts. No maintenance. Patented electrical heating elements prevent ice spots or hot spots. Confusion in wing, tail and propeller surfaces. Starts instantly.



PROBLEM: Protect remote radar antennas.
SOLUTION: Air dropped inflatable radomes.

ADVANTAGES: Protect radar antennas from wind and weather. Can be erected by air-man crews in half hour. Can be air-dropped in sections. Inflatable, already proved in other radar applications.



"Engineered Value" is a Goodyear exclusive. It means extra value in products developed through the unmatched capabilities of one of the world's largest, most experienced manufacturers of aircraft components—Goodyear. Since Kitty Hawk, Goodyear scientists, engineers and researchers have been solving flight problems with "engineered value" products. For more details on how Goodyear's broad capabilities can help solve your problems, too, just fill out and mail coupon today.

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Fiber glass propellers for U. S. Military VTOL research plane

The X-22A Navy Research Vehicle, built by Textron's Bell Aerosystems, will be a dual-engine, ducted-propeller, VTOL aircraft. It will be designed to carry a two-man crew and six passengers or a 1800-pound cargo at speeds up to 330 mph.

The unusually light, tough propellers required by the X-22A will be developed by Hamilton Standard. Each propeller has an integrated push box and straight blades constructed of fiber glass with a central steel spar. This advanced design will make possible considerable weight savings. Hamilton Standard is also building lightweight propellers for the XC-142A, the Tri-Service V/STOL transport under development by Chance Vought with Hiller Aircraft and Ryan Aeronautical.

Each X-22A will have four ducted propellers, arranged in dual tandem. The ducts increase propeller thrust during vertical takeoff and landing, and supplement wing lift during forward flight. Four General Electric T-58 engines will power the propellers through an inter-carrier shaft system.

These propellers are only part of a comprehensive development program under way at Hamilton Standard for new lightweight VTOL and STOL propeller systems. This work is a natural outgrowth of more than 40 years of designing and producing propellers for the aircraft industry.

Hamilton Standard

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A**
DIVISION OF UNITED AIRCRAFT CORPORATION
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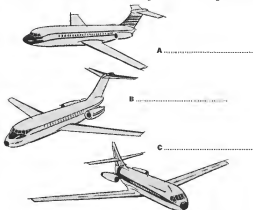


Gemini Boilerplate Used In Water Drop Tests

Successful landing sequence shows Gemini recovery system during water drop tests with a boilerplate spacecraft. Phases of the landing sequence, being guided by Vietnam Dev. of Northrop under contract to McDonnell Aircraft, are set to be released. Water drop tests are being conducted at the Navy's 3515th Parachute Test Facility, Naval Air Station, in Corpus Christi, Texas. In descent, an 84-ft.-dia. ringtail pilot parachute is water ejected at 30,000 ft., followed by a recovery signal. The pilot chute pulls the instrument and recovery canister from the top of the vehicle and extracts the crew 84-ft.-dia. ringtail chute. The spacecraft is changed from a vertical to a 30-deg. nose-high attitude by a sequencing of boiler drops. Final descent is at 10 ft. Parachute disconnects from the spacecraft automatically upon impact after which the Gemini capsule, built on its side in the water with the effort under all possible circumstances, is hoisted. Northrop-Venture is now supposed to supply two recovery systems, instead of the original two, providing for recovery of vehicles two through six. Recovery of the last vehicle is not planned.



Can you identify these 3 new short haul jet transports?



Perhaps not... they all copy the basic Caravelle design that has proven so successful in 4 years of airline operation—has been selected by 21 airlines throughout the world. All of these new airplanes are designed for the same basic job, but one, the SUPER CARAVELLE fan-jet, has more capacity than the others—between 8 and 14 additional passengers versus the Caravelle—and greater range for increased versatility. More passengers more miles mean greater profits.

The new CARAVELLE has the only fully developed all-weather landing system, and basic systems are fully proven in more than 600,000 hours of air-line service. It has all the advantages of the very newest without the risks of the untested, plus added profit making capacity.

Looking at copies of the Caravelle? Check the New SUPER CARAVELLE—the ideal new jet for route segments ranging from short short to 1500 miles.

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Costs Prime Factor

Preliminary costs involved in the fabrication, testing, transportation, and assembly of future space vehicles made necessary the development of reusable launchers and spacecraft, according to NASA Research Advisory Committee.

Evolution of present lightweight structures has resulted in lower weight at higher costs, the committee noted. It is strongly urged that cost be a primary consideration in evaluating alternative designs.

The structure of many major test facilities, such as those for space launch vehicles and those now down or redesigned for new uses, will be too costly in future space missions, the committee said. It advised limiting the number of future test facilities to universal units with multipurpose capabilities.

Differently arranged components could be reduced considerably by a conventional mode construction, yet, test facility and launch platforms, the report said.

nuclear reactors will be needed. Fabrication of refractory metal has demands into various shape-castable alloys, which are used. In particular, much work must be done on forming and joining techniques.

Because of material restrictions in suitable nuclear reactors will result in the need to produce high purity parts as parts of exact composition. They could be fabricated using vacuum or laser deposition processes.

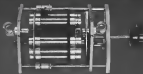
Design of cryogenic systems would bring about new problems, the committee felt.

Investigation into their distribution among material interactions and effects was proposed. These studies would try to relate and predict such systems to design parameters at very low cryogenic temperatures. Data on Young's modulus and tensile strength under these conditions should be obtained.

Liquid hydrogen and oxygen tanks which can withstand the high strains induced over many pressure cycles are required. Fiberglass reinforced plastic vessels compatible with metal tanks and made of boron fibers can be suitable.

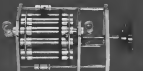
Expandable structures will be made of fabric which can tolerate high temperatures. This is particularly important for the assembly in space of large reflectors. Space radiator materials considered most promising for the near future were boron fibers, boron fiber-reinforced plastic and polyimides, in that order.

Complexity of the structure, required size structure will increase while lower costs are needed.



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attenuator db-step arrangement in 60 seconds!



Can't afford the time to pull apart whole attenuator units and send them back to the factory just to change db values or make a repair? A Stoddart turret step RF attenuator ends annoying downtime by providing simple, step-by-step operation of attenuator pads. Just loosen two screws, slide over a retuning ring, pull out the old pad and insert the new. You don't even have to resign the barrel (Our new did it all in 43 seconds, but it could take you a lot longer at first!).

Stoddart attenuators are Accurate: calibrations as high as 0.02 db per 10 db up to 1 or are available for attenuators through 60 db. Rigidity withstand environmental requirements of MIL STD 202 and MIL A 9355 without incurring physical damage or change in electrical characteristics. Available: guaranteed to meet all published specifications. Immediately Available: in attenuator pads with 2-watt ratings; turret attenuators at turn-outs of 2, 6, 10, 12 positions; RF step attenuators in 2- and 3 turret models. Contact Component Sales Division.

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AEROSPACE NEWS from Dow Corning

New silicone ablative material bonds in place... is lightweight... flexible

DOW CORNING® 325 Ablative Material has been selected by McDonnell Aircraft Corporation for the heat shield on NASA's Gemini spacecraft. There are numerous reasons, including:

Lightweight — For equivalent volume it weighs about one half as much as rigid reinforced plastics used for ablative applications.

Flexible — applied as a pourable liquid, Dow Corning 325 ablative material can be cast or molded... cures to a rubbery solid. Thermally induced stresses which tend to destroy rigid materials are absorbed by the elasticity of this new material.

Resists — Dow Corning 325 ablative material will bond to many metals, plastics and ceramics... has excellent shear strength. Cured pieces can be bonded to substrates with adhesives. New Dow Corning 325

ablative material will bond to already cured sections of the same material, and to most materials used for honeycombs.

Swells — when exposed to heat flames that cause it to char, Dow Corning 325 ablative material swells, thus increasing the effective thickness of the shield.



News Briefs



Silicones help simulate space...

Fairchild Camera and Instrument Corporation's Defense Products Division has a 3,000 cubic foot test chamber at Sylmar, Long Beach. It is used to simulate the environmental pressure at altitudes of 350 miles... varies in the range of 4 to 10⁻⁶ mm Hg.

Dow Corning® diffusion pump fluid is used in the 11, 32 inch diffusion pumps to achieve the desired test chamber pressure level. Silicone diffusion pump fluid offers superior resistance to oxidation, will not decompose or lose pumping properties, recovers 25 to 30 times faster than conventional fluids after exposure to air, eliminates the need to cool pumps before releasing vacuum, is chemically inert.

Dow Corning also produces a line of sealants for space chambers and other test facilities. Some resist radiation.



High strength, new resistant silicone rubber...

Wilex® 5500 rubber is a silicone stock designed for applications in stretch, open volume and ground support equipment. This 50 diameter silicone rubber provides high tensile strength, 1400 psi minimum, tear strength of 175 psi or better, a brittle point at -215 F, good heat stability at 500 F. This stock shows all the properties typical of silicone rubber and is designed to meet the requirements of the following military and commercial specifications: MIL-R 30711, Class III, Grade 50; MIL-STD 417, EA 519 and EA 512; AMS 3245 and SAE-ASME EA 500 and EA 502. Parts made from this material are available from many companies fabricating rubber parts to meet the specialized requirements of aerospace applications.

For further information about any of the materials mentioned here... or our capabilities to provide you with tailor-made materials designed specifically to meet your requirements, write Dept. 0921, or call Engineering Products Division, Dow Corning, Midland, Michigan.

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"Cindol" lubricants lay wide open new opportunities in product design. Take advantage of the many high-performance qualities of aluminum, some of which have never been—could not be—exploited. All because of aluminum's recognized tendency to gall when aluminum slides over aluminum surfaces. New "Cindol" provides lubrication for ball bearings and many other rotating

components, close-tolerance parts, machined parts. All this is possible today because of "Cindol's" ability to eliminate:

We are now producing "Cindol" lubricants in several forms. Very soon, we will have a complete family of industrial lubricants: lubricating oils, reliable cutting oils, straight cutting oils, rolling oils, drawing compounds, the cooling lubricants, lubricants for cold chisels, dies, pins, points, grinders, reliable sealing and water transferable coats.

"Cindol" is now being used on aluminum surfaces in contact with aluminum or steel . . . contact: look, however, show promise for slides, hot tools, galvanized steel, titanium and other workable metals.

See E. F. Houghton for exactly the right "Cindol," and the right application technique. To learn more about aluminum's bright future, we suggest you send today for your copy of Cindol Technical Data Folder. Write E. F. Houghton & Co., Dept. (33), 203 West Labagh Ave., Philadelphia 33, Pa.

*Frictionless polished ball, polished drawing

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USAF Rocket Study to Measure Pilot's Role in Mission Success

Los Angeles—Program to determine and disseminate the importance of mission success stemming from use of a pilot in the operation of a rocket propulsion system will be supported by Air Force Flight Test Center, Edwards AFB. Funding is expected to be about \$175,000 for a 10-month effort for which proposals are due from industry bidders by Sept. 24.

Philosophy behind the program is that the design, test and redesign method of propulsion system development has fallen short of the desired goals of achieving high reliability in the shortest possible time, thus requiring a new approach to propulsion system design and control.

Improvement in mission success for future system will depend not only on solving present problems, it is felt, but also on effectively using pilot or crew participation in propulsion system testing and operation. Pilot or crew control, along with special design features to maximize accuracy at various of conceivable configurations, may provide the degree of mission success desired at a controlled

reliable information regarding status of critical components in subsystems in the propulsion system.

Operational alternatives must be determined for pilot to apply his abilities effectively.

Minimizing and control of components or functions must be within the response time for pilot or crew computer workload.

Component status or functions which fall outside the capability of crew control will have to be established. These areas will be studied to determine methods of increasing reliability through status or component design modification, redundancy or backup systems, automatic sequencing, fuel safety, and automatic reversion to a safe operating level.

Phase 2 is expected to result in personnel system schematics and component design for utilization of crew capabilities to achieve maximum mission success. Schematics and design will be based on propulsion systems in the following:

- Titan 3 launch vehicle
- Booster using integrated component

Propulsion Analysis

Air Force Flight Test Center's request for proposal No. 675447, dated Aug. 12, 1964, seeks expert to analyze of propulsion system monitoring and performance by pilot and crew status that for the many test and operational flights conducted during the first year period 1967-68. Early methods have resulted in booster failures and occasional test anomalies.

Of this number, 41% of the failures were a direct result of malfunctions within the propulsion system itself. These failures, which resulted in lengthy test development time and expenditure of millions have cost the government not only time and propellant, but software of dollars ready to turn of hardware design and unscheduled test operations.

Guides are used to optimize complexity and search and development lead time of future flight vehicles demand that booster and space propulsion systems achieve a much higher degree of mission success and demonstrate a much lower test flight, AFVTC controls.

In addition, software factors such as system software time, flexibility, display rate, and system failure consequences create conditions which make propulsion system reliability and the resulting mission success even more important, if pilots and



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- Goldring & Lee's Boring, Drilling, and Milling Machine, No. 45-400-100
- Fast & Whiting Type C Machining Machine

Other important facilities in Fenn's catalog, also include a facilities index.

- J&F Horizontal Bore No. 4 Machine, Model 400-100, Swath 40" x 100" depth
- Swathed 40" x 100" Swath 40" x 100" depth

Write for copy of Fenn's "Facilities for Numerically Controlled Companies" and "List of Present Machinery and Equipment."

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Aircro also engineers special equipment for controlled precision welding of sensitive structures. Example: SAMPAC equipment for large missile sections. It enables you to weld with less expensive tooling, less dead

weight and easier operator control than ever before.

Learn more about Aircro processes for precision welding. Contact your nearest Aircro office for complete details, or write Air Reduction Sales Company, a division of Air Reduction Company, Inc., 150 East 42nd Street, New York 17, N. Y.



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engine, in accordance with Aeroquip Corp. design under Air Force contract DA 31-113017.

► **Feathering** (upper stage) of Titan 3. ► **Advanced** upper stage repositioning a 30,000 lb thrust engine using variable propellants.

► **Manual** maneuvering attitude weighing 15,000 lb, into a more propellant economy using attitude propellants and delivering 30,000 lb thrust. This attitude would be boosted by Titan 3.

Phase 3 will be conducted to verify and refine work under phase 2. Examples of pilot control functions will be demonstrated with computer emulation. Recommendations for methods of incorporating pilot control into future propulsion systems will be made.

Twin Gyros Proposed For Vehicle Attitude

Cambridge, Mass.—Attitude stabilization of a large space vehicle during the maximum phase of flight using twin gyros as sources of torque was proposed recently at the American Institute of Aeronautics and Astronautics Guidance and Control Conference here.

The ability to stabilize vehicle attitude to within a few seconds of arc will depend on the enhanced navigational guidance equipment.

Two systems, one an automatic closed-loop and the other pilot operated, were submitted by researchers at the NASA-Aeros Research Center. In the closed-loop system, attitude stabilization within 1 sec of arc was found to be possible. The automatic-operated system was capable of stabilization within 5 sec of arc.

The attitude stabilization system uses two twin gyros to control each space vehicle axis. The gyroscopic cross-coupling which occurs in single gyro system is eliminated. As a result, large gradual angle deflections are possible. Most of the stored gyro momentum can be transferred to the space vehicle and as astronaut can provide independent control of each vehicle axis.

The single axis control simulator at Aeros Research Center has a pair of two-axis tucker attitude sensors, an electromechanical attitude display, a signal processing circuit, a twin-gyro commander and the sequencer.

Comparison of the twin-gyro system and a hydraulic pendulum motion control system showed their weight to be about the same.

However, the two-gyro control system showed significant weight advantages over the motion control system when attitude stabilization had to be maintained for a few hours.

Twin-gyro system could be powered by a combination of batteries and solar cells, or entirely on batteries.



COOLING PROBLEMS HAVE CHANGED, TOO!

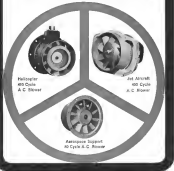


Fans like high performance and compact size are now vital. And blowers today must be quiet — long service life is critical. *

That's why Electric Boat's extensive line of vaneless blowers, utilizing unique slotted blade or mixed flow impellers, are being specified by so many design engineers in the defense products industry. *

► In critical service on board nuclear submarines, aircraft, aerospace support and defense vehicular systems, these blowers have demonstrated their reliability and quality. ► Pre-tensioned slotted blade or mixed flow impellers are integrated quickly with customised casing and drive arrangements — or specially designed units — to best suit your system specifications. *

► So if you're faced with equipment heat exchange problems where the solution depends upon performance, size and reliability of hardware, contact General Dynamics/Electric Boat Blower Products Division, Section A, Groton, Connecticut, Area Code 203, Mailing 5-4201, Extension 1532 or wire THRU NLM 475.

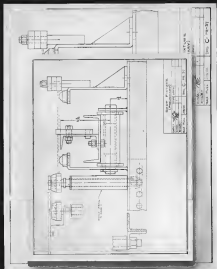


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XEROX
CORPORATION

R&D PAYOFF

MORGAN HILL, CALIFORNIA—Low erosion rate and some 100,000 pounds thrust for 135 seconds at high 35-ton segmented solid-propellant flightweight booster in test fired by the United Technology Corporation for Air Force Space Systems Division. Extended

demon firing paves the way for multi-officer, pound thrust rockets. (U) In this significant solid-propellant achievement, a composite of U. S. Polymers Poly-Preg graphite tape and silver tape showed uniform erosion rates well below those heretofore attained in large rocket firings.



Leader in research, development and supply of reinforced plastic prepreg materials for aerospace applications.

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USAF Building Expanded Range Center

Cape Canaveral—Air Force's new Range Control Center here will provide improved and expanded control over the 10 downrange tracking stations. 18 rooms stands more than 10 extra square yards and more than 100 solid-state electronic optical systems which comprise the Air Force Missile Range (AMR) and, in addition to this point, will serve as a command post for orbital missions and global tracking operations.

Now under design by the Air Force Missile Test Center (AFMTC) of USAF's Systems Command is the Space Proponent Co. of Sperry Rand Corp., the facility is planned to have a completely equal to the extraordinary sophistication of new range reference frames and more complex range use as criteria. Because for the future. Specifically, the new control center will be able to support simultaneously the command of two missile launches and one spacecraft in orbit.

In practice, successful demonstrations of this capability will depend on the careful scheduling of actual factors: the types of missiles being created down at the same time; the relation of their payloads to the orbital spacecraft; the support demands of ground stations in the orbital vehicle and the ground stations involved.

Each of the following hypothetical instances would be examples of the complexity and yet the difference between them is considerable.

• **Countdown of two Atlas-Agona** vehicles with Mariner payloads (one goes near, and the other back-up) while a manned Gemini spacecraft passes over the southern end of the range from waiting sub-launchers.

• **Countdown of a Titan 1C** with a payload intended to rendezvous with an orbiting, manned Deimos Star vehicle, while a Minuteman is coasted down for a research and development in-flight downrange.

According to Lt. Col. Max Fendell, AFMTC range project officer, the new control center—plus new Command center being installed at downrange—will be able to accommodate the simultaneous launch of two missiles and if they are of the same type, such as a pair of Titans 1C. Attempting to launch an Atlas and a Titan 1C, which require different instrumentation support, probably would require a delay of about a half hour between flights. Present, Control Center and range instrumentation have to give a wait of at least a half hour between launches of the same type, and of several hours if they are different.

The new Range Control Center will

be a three-story building with a 97 x 33,341 sq. ft. It will absorb the old Control Center while will be taken over by range safety operations when the new building is completed. According to the terms of the contract, Sperry will design the systems intended for the facility, manufacture those hard ware items which cannot be purchased, install and check out the equipment and then turn both USAF personnel and range contractor employees. A separate contractor will be chosen for members of the building.

All activity within the new center will center in a large three-story room occupying roughly half the floor surface of the building and extending through the three-story height of the structure. This room, in fact, will be divided into three operational areas of approximately 40,000 sq. ft. each. Class consoles will be arranged in two rows of 13 and 11, respectively. A single row of 16 will be in a balcony room on the second floor.

On the wall opposite the consoles will be seven 8 x 4 ft. display—four static status boards and three dynamic trajectory screens. One status board and one screen will be assigned to each of the three operational areas,

with the middle area assigned a second status board.

Three of the four status boards will show the go/no go condition of the major telemetry receivers, command and communication transmitters, optical trackers, tracking beacons, range safety beacons and mission down up and down the AMR. The fourth board will display the status of equipment at stations on the Pacific and White Sands (N. Mex.) missile ranges and other installations throughout the world. It will be known as the lead range board and will be associated with the middle operations area.

Adjacent to each status board will be a rear-view perspective dynamic display, upon which as many as four different missile trajectories or orbital paths may be projected against one of four backgrounds. Perspective, one of the video-screen type, in which a trajectory along X and Y coordinates—displays an opaque bar on a clear glass slide.

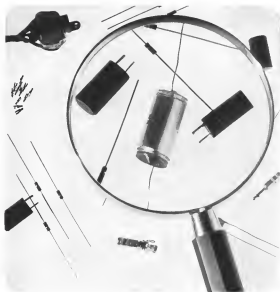
Along with the status board, the opaque bar area, a screen upon which a typical background depicting the Atlantic range has been projected from another screen.

In this manner, three crew can con-



Gemini Simulator Shipped to Cape

German electronic simulator has been shipped from McDonnell Aircraft Corp., St. Louis, Pennsylvania for the two-man spacecraft, to Cape Canaveral, where the Fairchild Space Test Div. of National Aeronautics and Space Administration's Manned Spacecraft Center has need of it for training and checkout tests. The dynamic spacecraft simulates all five modes (light to full, adaptive, active, active control, rendezvous and recovery) and is situated in three dimensions and about the same weight as the flight model.



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duct separate sensors. A value which might be superimposed on Azimuthal Band, for example, would show up as a red (or green) light on each of the three AMR status boards. To a USAF crew in the first operations area, this would mean a delay or postponement in its planned mission to fix a Ties 2 into the Azimuthal unit. But to a Navy crew in the third area, the red light opposite Azimuthal status would have no bearing on plans to launch a Pelos into the same area off Annapolis.

The row of 15 consoles facing the display wall will be manned by about eight USAF operators and officers, including liaison officers from the Sixteen Command (referred to as the Strategic Air Command) and public information and range control officers from the AFMTC. These personnel will primarily coordinate between the AFMTC and other USAF installations around the country.

The 11 consoles immediately behind and about 5 ft. above the first row also will be manned by about eight operators and officers, but these personnel will be representatives of the various status-liaison, missile or controlling the orbital spacecraft. These consoles, in addition to regular launch and flight-assisted equipment, also will include three live TV monitors, each capable of displaying three channels of information.

Above each set of status boards and display screens are a series of five circular, northward display showing such information as Greenwich Mean Time, countdown time, elapsed time, test number and extent of test time.

Dominating the facility will be the middle operations area, because it contains the board showing the status of all ranges and tracking stations. A television camera mounted above and behind the middle operations area will photograph this board. Other operators also will be able to view the status board by viewing the appropriate TV channel button.

Overlooking each of the operations areas on the floor will be a separate range operations room on the second floor of the new facility. In each of the three range operations rooms will be 35 consoles—11 for the uppermost of range operations and five for the lead range operations.

The superintendent for range operations himself will be in charge of information, according to Col. Fendell, and will be responsible for the launching status, inspection display and the actual launch action. The lead range superintendent personally will gather data on the status of equipment at ranges and sites other than the AMR. He and his assistants will gather the data in talking to the ranges and status involved. It will then be dis-

played on the lead range status board.

Across a hallway from the range operations room on the second floor are four additional rooms.

• **Emergency control room.** This is the chief superintendent of range operations and their assistants will monitor consoles displaying the activities of each one of the three operations areas on the floor. They will monitor the status of approximately 300 launch and lead range instrumentation sites and direct fire-control from its display room.

• **Recovery control room.** This operations room will monitor the status of all AMR, missile, and two pilot boards on which predicted missile impact points can be viewed in relation to aircraft position.

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• **Support test room.** Two operators at three consoles here will coordinate the activities of blackboard, Range Control Center and other installations both on Cape Canaveral and elsewhere.

Control Center Funds

Cape Canaveral, USAF's new Range Control Center will be paid largely from National Aeronautics and Space Administration funds. Both NASA's Launch Operations Center (LOC) and Air Force Missile Test Center sought money for the new facility in their 1964 budget requests. Congress allowed the rule in LOC's establishment, apparently because of the civilian agency's expected profit impact on the range in future years with its Gemini and Apollo programs, but denied USAF to do the work.

USAF has been the Defense Dept. agency charged with overall range responsibilities since the creation of the Air Force Missile Range in the early 1950s.

NASA will put up nearly \$12.5 million for the center, of which \$2.1 million is for installation of equipment and about \$800,000 for the building.

USAF recently awarded the Space Performance Co. a \$450,000 contract for design of the interior within the center and installation of both prototype equipment and all hardware taken from the present rented control. Of this figure about \$500,000 came from NASA funds and \$250,000 from USAF Fiscal 1963 money. Discounting \$0.5 million will be spent for quantity purchases of other than prototype equipment.

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Learjet engine, which CJ602B, is fitted on right-hand side mount (above). Both engines and wing have now been installed. Large, self-fed Foster-type flap (below) are shown extended; spacers are located just ahead of flap. Tail is mounted to front seat bulkhead.



Lear Jet Prototype Nears October Flight Date

Excellent bridge of constant cross-section, designed to keep structural weight down and reduce drag, is emphasized in stressed view



Prototype Lear Jet business aircraft is nearly completed and the company reports that it will start flight test program "somewhere Oct. 1" at the Wichita, Kan., base.

A second prototype, to be used as a static test article for all ultimate load and gross weight tests, including maintenance in a water tank, is now being built.

Test program is geared toward Federal Aviation Agency certification in April 1964, by which time the Lear Jet should be in flight status. Deliveries should begin shortly after certification and Lear Jet Corp. anticipates that it will deliver 40 aircraft in the fall of 1964. Production requires a long planned business possible delivery requirements in mind and would provide a capacity for turning out 10 planes monthly if needed.

Debuter working program is still being formulated, but is expected to be completed shortly, possibly later this week. Indications are that in the initial stages, at least, sales would be handled primarily by the factory, with some strategically located subsidiaries being appointed sales representatives.

The company reports that it has signed firm purchase orders, with deposits, but is reluctant to discuss specific numbers. At least one firm order has been negotiated through Lear Jet's Energy-Mark, Test-Mark representatives. Additionally, General Motors, the customer buying the Quon-Group, Germany, delivery of this airplane is scheduled for 1964.

Lear Jet powered by two 2,810-hp General Electric CJ602Bs will be priced at \$196,500 for the standard airplane completely equipped. This will include a high decelerating cruise motor for seven sea engines plus two sets and periods of electronic equipment including dual engine non-communication gear, engine-actuated, weather radar with high frequency indicator distance measuring equipment and transponder. Differences in price from \$189,000 quoted earlier is that the 100-gal. fuel tanks had been formerly optional for an additional \$7,500, is now considered standard, factory installed equipment.

The aircraft will include devices developed by Lear Jet Corp., such as an auto-rudder, varying cruise control, engine flight trim, such as Mach limit speed, about 1,000 and landing gear warning.

Some delay in starting scheduling for first flight resulted from: decision to make a new gear design in full consideration of the first prototype (AW Nov. 26, p. 17); 47 days being consumed in the time the final drawings were released to the shops.

New tail provides increased stability margin and the horizontal tail surface was moved along the vertical stabilizer to remove it from the effects of engine exhaust, reducing some fatigue problems. It is anticipated that the new concept, T-tail configuration, will also permit further growth in power plants without necessitating additional wing changes.



Looking forward (above) in Lear Jet fuselage, with large control visible at left for 5 x 4 ft door. Bulkheads are riveted around the door for structural integrity.



Engine area (top (left, above) is visible in forward view. Cabin seat features in lower-left area. New stabilizer (below) screens wing from 6 deg. to 35 deg.





Phantom aft fuselage section (above) and stabilizer (below) being assembled at Republic Aviation Corp., under subcontract for McDonnell, are 25% titanium, heat welded jet weld heat

Titanium SST concepts get rugged test on fabulous Phantom



Tomorrow's design problems being solved by today's Navy-Marine-Air Force Fighter

Hidden in the tail section of the McDonnell F4B/F4C Phantom, tucked where the hot jet wake sets the thermal pace, are titanium structures. Like a buried cross-country, they carry designers to tomorrow's Mach 3, high-performance aircraft.

A total of 321 pounds of titanium is used in the aft fuselage section alone—more than 25% of its weight. It is used in bay areas, where titanium's combination of strength and low weight, toughness, stiffness, and resistance to fatigue, physical stress, corrosion are needed to stand up under high loadings at intermediate heat ranges up to 900°F, with limits even higher, vibration, aerodynamic buffeting, cyclic loads.

An inert titanium has the properties needed to make the supersonic transport a practical reality?

More than 100,000 hours of flight, selection by three services, scores of speed records have probed, and tested these vital titanium structures: the stabilizer torque box and forward section and the tail cone, which drive in the swirling ambience of the jet wake, the access doors that surround the tail pipes, and the 18-foot stiffened web in the tail beam between the engine, plus many other titanium parts.

For more than a decade, McDonnell, which is noted for the development of its multiple landing, has continued to use more and more titanium in its aircraft. The F4B/F4C uses more than twice as much titanium as the F201, 10 times as much as the F1. It can be said of titanium that no other metal usage aluminum has been so thoroughly tested and tried, proved in flight, and found so reliable.

A whole spectrum of fabrication and titanium mill products goes into the making of a Phantom. Titanium Metals Corporation of America supplies much of the titanium, a network of fabricators spread across the U.S.A. supplies a multitude of parts. This capacity and technology is available now... today... to help solve tomorrow's Mach 3 problems.

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Stiffness. Strength characterizes the design underside of the aft fuselage section. Area is directly adjacent to jet blast. Despite jet shock, operating temperatures reach 700°F. Frame and skin material is 6032-Ti-6Al-4V.



Heat treating is used extensively in producing parts for the all-titanium tail cone. Frames are 6032-Ti-6Al-4V alloy (Ti-6Al-4V), skin is 6032.

Resistance to fatigue and thermal stress make titanium major choice for skin, ribs, and spars in key areas of stabilizer. Torque box, with its 0.350" Ti-6Al-4V skin, must withstand cyclic loading, plus aerodynamic buffeting, at temperatures of from 650 to 1000°F.





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MANAGEMENT

Senate Committee Calls Test Ban Small, Firm Step to Arms Control

By Katherine Johnson

Washington—Nuclear test ban treaty "represents a small but firm step toward arms control, and that bears a special sense that lies beyond its brief and simple text," according to the formal report issued by 15 of 17 members of the Foreign Relations Committee.

The only constructive vote against approval of the treaty banning atomic, space, underwater, and space testing was by Sen. J. Lee Smith (D-La.). Eighty-two nations have signed the treaty negotiated by the U. S., U. K., and USSR.

"The maintenance of a strong military position is clearly essential to the national security of the U. S.," the committee stated. "But excessive, as excessive, reliance on military readiness could undermine national security by concealing comprehensible motives of efforts to achieve a more strengthening the destabilizing forces which in the world, possibly creating new ones."

The committee raised the possibility that the USSR, through underground testing that is categorized by the treaty, may have the U. S. lead in some "critical areas" of nuclear development. It added: "But it is equally true."

Military, Scientific Treaty Views Clash

Washington—Divergent outlook of the military and scientific communities toward the nuclear test ban treaty was further emphasized in letters released by Senate Foreign Relations Committee.

Sen. Arthur H. Hays, former chairman of the Joint Chiefs of Staff, called for rejection. Two former atomic scientists—Dr. Leo Szilard and Dr. Hans Bethe—gave strong support.

"Nations whose responsibilities include the defense and security of our country are worried about this treaty," Bethe declared. "It goes with some of our former colleagues in expressing deep concern for our future security if this treaty is ratified as it now stands."

"Almost certainly it is an agreement which will ultimately result in the USSR obtaining important advantages in the development of more advanced atomic weapons with all the disadvantages that this implies for us."

Szilard said that the treaty agreement will achieve its objective of preventing peace only if followed by free political agreements between the U. S. and USSR.

"If it was not done," Szilard said, "and if the government proceeded with an extensive program of underground bomb testing, then, rather than facilitating the cause of peace the test ban agreement would be likely to do just the opposite."

The underground testing is very expensive and, since the Soviet Union is economically much weaker than the U. S., it would in the long run be forced to stop the program.

Bethe discussed the qualifications of Dr. Edward Teller as a witness on the anti-intercontinental ballistic missile (AIMS) talks, the only scientific experiments who specifically called for treaty rejection during Senate testimony, based his case on the contention that the USSR already possesses the know-how to develop and deploy an effective AIMS system and that the U. S. will be prohibited from this by the ban on atmospheric testing (AW Aug. 26, p. 35).

"The complexity has been looked at the entire AIMS problem, even unanimously of the opposite opinion to Dr. Teller, who has only worked on a small phase of the problem—the nuclear weapon," Bethe said.

There are legislation of test ban treaty issued by Senate Foreign Relations.

• USAF Chief of Staff Gen. Curtis LeMay expressed concern that the USSR may have obtained information during the 1961-62 test ban talks to the U. S. "If this is true and they do know more than we do they may have something that we will not be able to do. They may be able to pick up a weakness in our defense system that they can exploit."

• Gen. Maxwell D. Taylor, chairman of the Joint Chiefs of Staff, which supported the treaty, with widespread-undisputed disapproval USSR testing. He commented:

"I don't think we military individuals can afford to assume anything other than the worst in this particular field, and we did take our position on the treaty with the assumption that Soviets would attempt clandestine testing of some sort."



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that this gap could be closed with many rapidly developed testing systems. In short, the effort at the treaty will be to slow the rate and significantly increase the expense of Soviet progress in these technological areas in which the U.S. has superior skills.

The committee evaluated the three major risk posed during the extensive and conflicting testimony (NAV Aug. 16, p. 28).

• **Offense.** The treaty makes "no serious risk to the continued capability of U.S. missiles to penetrate air defenses unless that a potential adversary might reasonably be expected to develop."

Atmospheric testing could provide additional useful knowledge regarding the effects of blast and radiation on aircraft warheads and re-entry vehicles. However, the limitation on giving that knowledge will inhibit both the U.S. and the Soviet Union equally, although probably not seriously in either case.

• **Defense.** The treaty has not set off a development of so many intercontinental ballistic missile weapons (ABMs) to any appreciable degree "since the warhead is a relatively simple part of the complex system. The committee expressed doubt that either the U.S. or USSR would ever develop an ABM system capable of protecting population centers and civilian targets, but noted that the U.S. continues a vigorous ABM research and development program. "Apart from their defensive purposes, efficient antiballistic missile systems perform a critically important function in testing the reliability of penetration aids for offensive missiles," it said.

• **Risk effects.** The committee said that "the most serious inhibition" imposed by the treaty is the loss on atmospheric tests to determine the effects of nuclear bursts on communications blackout, radar blackout, and radiation weapon vulnerability. On balance the risk was found "acceptable" and the committee concluded that "it will not restrain either the U.S. in developing and maintaining missile systems that are capable of performing the functions for which they are deployed."

On the surface behind the USSR's opposition to the partial testing ban—after rejecting almost identical proposals made by the U.S. since April, 1959—the committee noted the following points:

- From extensive atmospheric testing in 1961-62, "Soviet scientists presently are confident that in many critical areas of nuclear weapons, they have achieved a rough technical parity with the U.S."
- Last fall's Cuban crisis was "a sobering experience."
- The Sino-Soviet struggle which "per haps in larger part... threatened ide-



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ship and reflects an inevitable conflict of interests between a united and expansionist China and one of her historic antagonists, Russia."

• Arms expenditures have had "a depressing effect on Soviet economic growth. In the past five years, Soviet military expenditure has risen significantly, while the rate of increase in the gross national product has dropped sharply."

• Soviet leadership "seems to share Washington's concern with the problem of proliferation of nuclear weapons." Adds that China and Russia, convinced with the capacity and intent to develop nuclear weapons have announced they will accept the testing ban.

The conclusion was that China would probably explode a nuclear device next year.

DOD Regulation Seeks First-Class Fare Curb

Washington — General Accounting Office, claims that defense contractors use of first-class air travel has become excessive but the Defense Dept. is issuing a new regulation prohibiting reimbursement for this type of travel as a part of negotiated contract costs.

On the basis of a GAO survey of 20 defense contractors' travel costs, the Defense Dept. has issued the new provision in the Armed Services Procurement Regulation for distribution to all contractors by Oct. 15. The provision limits reimbursement to first-class fares or less, unless the contractor can prove that purchase of the highest fare accommodation was unavoidable and justified.

Despite repeated requests that the contractors adhere to the government's general policy of using only lowest air fares, little progress has been made over the past two years, GAO contends. It explained the total savings that could be realized by contractors' adoption of the policy and pointed out that past surveys showed that companies by using two contractors resulted in a combined saving of more than \$1 million in non-transferable travel costs. Examples of fares chosen low cost, rather than first-class fares, whenever the two were offered on the same aircraft or the planned flight was less than 5 hr duration.

Detailed analyses of the travel records of the 20 contractors for a three-month period last year GAO also disclosed that some authorized expensive first-class air travel through one of the following actions:

- Major manufacturers' ruling that no planes were based on evidence unless regardless of the availability of less costly accommodations.
- Blanket authorization for first-class



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tand on police engine itself and for baggage.

- Unrestricted use of first-class travel for flights after business hours.
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- Failure to enforce the policy since it was adopted.

Specifically, GAO charged that Lockheed Aircraft Corp., Marietta, Ga., has denied its employees to take 87 first-class flights between Marietta and Washington D.C., as a customer air line even though less costly accommodations were available on other airlines.

However, the manufacturers said it had already begun to enact this practice and adopt the economical air travel policy, which produced a contract savings of \$117,000 in 1983.

Companies Cited

GAO also said that Sperry Rand Corp., St. Paul, Minn., and the Aero Corp., Biscade, Tex., both authorized employees to use first-class accommodations on nonfederated aircraft even though more economical fares were available on the same flight. In a single two-month period, GAO said, Sperry Rand purchased 394 first-class tickets on nonfederated flights of which 213 were turbo-prop-powered. In addition, 180 first-class jet flights were also used when less costly accommodations were available. Neither company replied to the GAO report, but Air Force spokesmen have indicated that the firms are now complying with the economical air travel policy.

Mitre Corp., Bedford, Mass., and Raytheon Co., Andover, Mass., put out a statement that use of first-class travel on any type of aircraft or flights under after business hours, according to GAO.

Mitsui Study

Mitsui said earlier that it had been studying the possibility of entering air travel expenses as line items on the government policy. Although the company did receive two civil regulations to some extent, GAO and its services showed that 983 flights, or 79% of the 1,238 flights made in the three-month period, involved the use of first-class fares. Even after the contractor revised its travel policy, 55% of the flights made in the first month after the revision were first class between the hours of 5 p.m. and 9 p.m.

In a similar manner, 104 of 670 flights made by Raytheon employees were in the first-class category.

GAO emphasized that while neither firm commented on the new legislation, the Air Force noted that it had approved Mitsui's policy authorizing first-class air travel after business hours. A



Taber transducers help STL seek moon landing solution

Taber TELEDYNE® Pressure Transducers are assisting Space Technology Laboratories, Inc. in the development of a dependable and efficient throttleable descent engine for NASA's Lunar Excursion Module (called LEM).

In tests of the engine prototype, the Transducers measure negative pressures, upstream and downstream chamber pressures and coolant jacket pressures.

Featuring bonded strain gauges, Taber Pressure Transducers are ideally suited to a wide range of test and operational applications. Compact and extremely rugged, they provide high overpressure protection, infinite resolution, 0.25% linearity and low sensitivity to temperature, shock and vibration.

Regarding the performance of Taber Transducers, the head of STL's Propulsion Division writes, "A good product, we like it and propose to keep buying it."

For detailed information on Taber Transducers, write:

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Taber Instrument Corporation

Section 45, 101 Devon Street, North Tarranton, N. J.



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MATCHES FASTER TO PROBLEM**

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NO COMPROMISE HERE

The HUCK BLIND BOLT is being used today in critical OEM and repair applications. These include general air frame applications... stabilizers... ailerons... wing skin-to-spars... and missile thrust structures.

The reason? The HUCK BLIND BOLT meets or exceeds NAS 2056-A design allowable. Undesirable "torque tension" load component is

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Huck Fastening System combines a strong vibration resistant locking with selected finish, exponentially increased torque, a unique blind superior fastener. In these areas of design and production problems: wide variety of sizes, head styles, diameters and grip strengths also fall freely in design and specifying.

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now air travel alone, eliminating this problem, was negotiated into the company's contract with the Air Force for fiscal 1965, as a direct result of GAO criticism, the office stated. Raytheon subsequently raised a screen in its own "own" policy.

Republic Aviation Corp., Farmingdale, N. Y., authorized first-class travel for company officers, 80 employees on the administrative payroll and top employees accompanying such personnel, GAO said. In a memorandum passed, the company policy resulted in the use of 161 first-class flights. Republic has since limited the first-class travel authority to officers of the corporation.

Although the survey indicated that most of the companies involved had revised their policies, GAO said, General Electric Co., Syracuse, N. Y., and DuPont Instruments, Denver, Colo., failed to enforce them. Travelogues from 1964 still accounting for 34 to 34% of the contractors' travel costs.

In both cases, the contractors pointed out that use of first-class accommodations were necessary, under less costly fares were not available when needed, and advised that a close surveillance would be maintained on these costs in the future.

PRODUCTION BRIEFING

USAF's Air Rescue Service has ordered four Sikorsky CH-53C twin-turbine helicopters for support of manned space flight programs at Cape Canaveral (VA) and JPL, p. 29. CH-53C, which can be landed in water, would be used to rescue or remove astronauts who short their flight during the boost phase.

Aeros Research Center is requesting proposals to conduct reliability analysis of the Pioneer spacecraft, now under development by Space Technology Laboratories. Bids are due Sept. 28.

Witte Corp. will send about 25 men into the Washington area to provide technical support to the Defense Gas Research Agency for the National Military Chemical System. The group, headed by Charles Zivert, will investigate coordination problems involved in the multisite system.

Research in biological micro-organism detection will be conducted by Spac-General Corp. under a \$708,880 contract from U. S. Army's Biological Laboratories, Ft. Detrick, Md. Project will involve development of an integrated air sampling device.

Handbook on effects of radiation on solar cell power systems is available from National Aeronautics and Space

Think Hot (175°C)

Think Cold (-55°C)



TACHOMETER GENERATOR SIZE 11

Mechanical Data

Mount at Inertia 5.0 in-lb max
Weight 7 lbs.
Amb. Temp. Range -55°C to 175°C
Shock 200 g in rms

Electrical Data

Voltage 115 v AC, 60 cps
Power 6 watts max
Output Voltage [per 1000 rpm, no load, over code averaging] 275 mV ± 1.0%
Frequency 0.1500 cps 4.0%
0.5000 cps 0.1%
0.7500 cps 0.1%
Full bridge full rms gain 12 mV/mV (peak)
Mini Link (at 3600 rpm over the frequency range of 360 to 600 cycles) 1.0 to 2.0 cps ± 4.0 degrees

Over the frequency range of 360 to 600 cps, the output voltage changes with load, around 0.5% per 1000 rpm. The input voltage range of 115/200 mV is the input range and not the output range with load, around 0.5%.

U.S. NAVY achieves unprecedented accuracy! Size 11 Tachometer Generator developed under contract for the Bureau of Naval Weapons Engineering Division, BUREN Incorporated the most advanced features sought to date by naval engineers. Output voltage variation will not exceed 2.0% spread over ambient temperature range of -55°C through 175°C. Write for Bulletin 6877 Wright Motors Division of Sperry Rand Corporation, Durham, North Carolina

WRIGHT
DIVISION OF
SPERRY RAND
CORPORATION

PROBLEMATICAL RECREATIONS 188



A divided highway provides a number of bridges, the arch over each lane being in the form of a semi-ellipse with the height equal to the width. A truck is 6 ft. wide and 12 ft. high. What is the lowest bridge under which it can pass?

A reminder: connections for virtually any analog, electronic, or commercial application can be had from our Winchester Electronics Division. Name your requirements! They've got every shape, size, and series you need to insure the integrity of vital circuitry. They make accessories and stand-off terminals, too. Eastern customers should write to 79 Willard Road, Norwalk, Connecticut. If you're in the West: 1317 20th Street, Santa Monica, California.

ANSWER TO LAST WEEK'S PROBLEM: 56, 2216, 3416, and 3616, 21, 1216.

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This could be your calendar—any week in 1963.

We believe this Business Week's "Short-Notice Closing" is the fastest and clearest of any major national magazine. It gives you last-minute, same-week insertion for one or two pages of advertising in any issue.

Business Week is read by the most important people in America for business advertisements—salesmen, executives. With "Short-Notice Closing," you reach these important decision-makers fast, with up-to-the-minute information they need for quick decisions.

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Deadline for Reservations: Monday at 4 p.m. Our Business Department in New York must have your reservations, at the latest, by 4 p.m. on Monday of week-of-

issue. For quickest service, wire (CWX 212-660-6646) or phone K. D. Rayolito, Production Manager, Business Week, 691-3676 (Dist. New York City Area Code 212).

Deadline for Plates: Tuesday at 1 p.m. To meet our "Short-Notice Closing," your plates must be in the hands of our Production Manager, in our New York office (330 West 42nd Street, New York, N.Y. 10018), by 1 p.m. on Tuesday of week-of-issue, at the latest (Sorry, no extensions possible).

Size of Color: Black-and-white: Paper or Special. Either one or two single black-and-white, non-bleed full pages, or one black-and-white non-bleed page spread (total bleed only) per issue. Only complete plates can be accommodated. Corrections, additions, or plate refinements are

not possible on so tight a schedule.

Printed at a premium of 30% will be charged over and above regular advertising space rates for the "Short-Notice Closing" service. Agency commission applies to purchase.

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when you want to influence management.
 A. B. Rothman & Company



USAF, Marine and Navy Phantoms Shown in Formation

In flight formation photo of McDonnell Phantom 2 fighters under USAF, PAC and Marine Corps and Navy F-4B assignments demonstrate configurations except for external weapons. Intruder version can carry either Sidewinder infrared seeking missiles or Sparrow 3 anti-aircraft missiles. Used in attack configurations, the Mach 2.3 aircraft can carry a variety of conventional and nuclear weapons.

Advertisement's Office of Scientific and Technical Information.

Bentley Pacific, North Hollywood, Calif. has been awarded a \$750,000 contract from General Dynamics Corp. for design, development and manufacture of pressure flight control systems for the F-111 (TF00) jet aircraft. The system will be integrally packaged as tandem with an output force of 10 tons and an input force of 2 oz.

Honeywell Acromatized Div., Minneapolis, Minn. has received a letter contract from Martin Co.'s Orlando Div. for preparation of preliminary design of high performance control system components for the Space astrodynamic module. The system will have to be fast reacting with inherent resistance to high loads.

Martin Co.'s Baltimore Div. has been awarded a contract by McDonnell Aircraft Corp. for production of replacement landing struts for the outer wing of the Air Force F-4H Phantom supersonic fighter. McDonnell construction will be used for the parts.

C & B Construction Co., Memphis, Tenn. will build the largest 1-pc 50-ton concrete bridge and stage acceptance building at the National Aeronautics and Space Administration's Marshall Space Flight Center. The contract is for \$15,155.

Allegory Instrument Co., Cranston, R.I. has a \$251,000 contract from Boeing Co. to design, develop, and build high temperature thrust accelerometers and vibration for measuring structural and panel vibrations of the X-20 (Dyna Soar) spacecraft during

flight. The instruments will be capable of operating at temperatures of over 1,700°F.

Aerotec, Inc., Schuylkill, Pa. will build automatic pneumatic release devices for the Air Force under a \$115-million contract. The devices will be built by U.S. Geopac, a division of Aerotec.

Fuehrlich Controls, a division of Fairchild Camera & Instrument Corp., has appointed A/S Dinsdale of Copenhagen, Denmark, as technical distributor for the company's products.

National Water Lift Co., Kalamazoo, Mich. has been selected by Boeing Co. to build hydraulic motor actuators for X-20. Value of the contract is \$465,000.

FOR PRECISION CONTROL



VAP-AIR gas-pressure, pressure regulator and electrically actuated bleed valves are designed to meet the toughest specifications for precision control applications. Light in weight, small, compact VAP-AIR Regulators, bleeders, actuators and valves are available in standard or custom sizes and configurations.

Jobs proved to diverse applications: controlling output and pressure compensating pressure, pressure ratio, regulated delivery and delaying action, engine starting systems, low back pressure systems. Many pressure VAP-AIR, gas.



For more information write for complete catalog.

The "Bleedless" Pressure Regulator device is extremely accurate in holding regulated downstream pressure under various operating conditions. Capable of compensating over 1000°F, it responds accurately and quickly to pressures as high as 500 PSIA, set open smoothly and reproducibly to pressures as low as 30 PSIA. "08-Shell" certified to 1", 1/2", 3/4" and 1/2".

For more than 25 years VAP-AIR specialists have been engaged in research, development and manufacture of highly temperature and pressure control systems.

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The Beechcraft U-8F...

How this all-around military "work horse" does big-plane jobs at small-plane cost:



BEECH "IMAGINUTY" IN AIR MOBILITY

Being rugged jobs for the U. S. Army—jobs usually reserved for "big planes"—is the specialty of this Beechcraft U-8F. Yet it costs far less to buy and operate than the big ones. Military commanders say the U-8F is the most versatile plane ever assigned to them. It gives them reliable all-weather transportation to meet a wide variety of military needs.

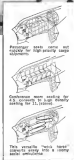
Even with big loads this U-8F operates safely from small, unimproved fields. Built the rugged Beechcraft way, it holds one of the best safety records in aviation today. Also, the U-8F is extremely popular as a multi-engine instrument trainer. It holds all the electronic navigation and communication equipment normally used by instrument flying as well as the largest searchlight. When your pilots maintain their instrument proficiency on this plane with its lower initial cost, lower operating cost and lower maintenance cost, the savings quickly run into hundreds of thousands of dollars.

What about power? This Beechcraft U-8F has twin 340 hp Lycoming supercharged fuel injection engines. Cruises smoothly at 190 knots with 70% power. Push it and you're over 200 knots. In worldwide use by the U. S. Army, additional U-8Fs are quickly and economically available.

Beech Aerospace Division
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HELPING BUSINESS GROW FASTER. Only Beechcraft's offers such a complete line of planes with so much speed, range, comfort and value to help business multiply the money-making benefits that each new man can make. That's how thousands of Beechcrafts have paid for themselves.



Becht Aerospace Division products include a full line of aircraft engine cases. These cases are designed to meet the most demanding operating conditions. They are built to last, and are available in a wide variety of materials and configurations. They are also available in a wide variety of sizes and configurations. They are also available in a wide variety of materials and configurations.

RESEARCHED, BUILT, TESTED BY THE U. S. ARMY AND NAVY. Beechcraft's U-8F is the most versatile aircraft ever assigned to the U. S. Army. It gives them reliable all-weather transportation to meet a wide variety of military needs.

006 The firm is producing eleven aircraft for the X-28 under an earlier contract.

Aviation has published a new Contract Cost. The guide lists the functions of the Army National Guard, its subordinate commands and its primary mission. Copies are available from Information Officer, Hq., U. S. Army Materiel Command, Washington 25, D. C.

Continuum Camera Corp., Los Angeles Calif., has a \$100,000 order from Hercules Powder Co., Cumberland, Md. for 35 mm camera, 1200 ft magazine, and PUPPET (picture and aerial photographic projection of digital data) automatic tracing unit. The equipment will be used on test stands to photograph experimental work in connection with second stage Polaris studies at Allgood, Ballistic Laboratory.

Acronomatic Div. of Philco Corp., Newport Beach, Calif., has been awarded a \$7 million contract for an extended research and development of the Stillhigh surface-to-surface tank mounted missile system.

Cubic Corp., San Diego, Calif., has received a contract to design and manufacture prototype nuclear reactor and subassembly assemblies for the P-111. The subcontract from Light Military Electronics Dept. of General Electric, is valued at \$400,000.

Gaslett-Ackersons Mfg. Co., Los Angeles Calif., has a contract to develop a pressure and thermal control system for the Titan 3 space launch vehicle. The system will cool and pressure electronic equipment contained in the vehicle's electrical power system. The contract, awarded by AC Spark Plug Electronics Div. of General Motors, is valued at \$400,000 and calls for development of flight test system.

Aerostatic Associates Inc., Los Angeles, Calif., will conduct research and development and launch support services needed to produce the propellant stabilization system for the Titan 5. The system recovers the fuel and oxidizer levels continuously and ensures their utilization in proper proportion during the flight.

Lockheed-Georgia Co., Marietta, will build a multi-building research center on property adjacent to its main plant. The center, scheduled for completion in late 1967, will house facilities for studying aerospace science, physics, chemistry, metallurgy, mechanics,

Remember the Navy Neptune?

GUARDIAN OF THE SEAS



(Continued from Page 1)

...and Barber-Colman was there!

Remember December 7, 1941? Only the day before, Lockheed engineers started their first work on the P-3V Neptune antisubmarine patrol plane. Because World War II demanded other Lockheed aircraft first, the Neptune didn't fly until May, 1946, but once production began, it didn't stop until 1960—a record run of continuous production for military aircraft, including seven successive model modifications. Current versions of the P-3V (also P-3) still fly Neptune patrols for the U.S. Navy.

A Neptune reconnaissance the "Trident" (P-3) off the assembly line, at a long-distance flight record in 1946 which still stands for propeller-driven aircraft—11,236 nautical miles, nonstop, nonrefueled, state-of-the-art, Alaska, to Columbia, Ohio.

Speedy refinement and modifications kept the P-3 operational on a wide variety of missions. For example, jet pod engines—made standard on the Navy's P-3V-3 (P-3H)—supplanted its

turbo-compound power plants during short takeoffs and whenever extra speed is needed. A Barber-Colman remote throttle positioning system for the turbine engines provides high-speed positioning (three seconds for three-inch strokes), to within .001 inch. If you are looking for new product versatility and reliability from actuators, air valves, or temperature controls, call your Barber-Colman representative. Or, dial in direct, Area Code 313-968-6633.

Today Barber-Colman products are used on Lockheed C-130 "Hercules" Titan II North American A-1J Lockheed P-3 Avion Targard Boeing KC-135

plus many other modern aircraft, rockets, and missiles.

"The art of progress is to preserve order amid change, and to preserve change amid order."

—ALFRED NORTH WHITEHEAD

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THE MARK OF QUALITY



AIRCRAFT AND MISSILE PRODUCTS: Air Valves, Dash-electronic Actuators, Temperature Control Systems, Positioning Systems, Transducers and Thermistors, Special Ground Test Equipment, POLYMER Electromagnetic Shielding.



TWO OF A KIND!

Cubic's commercial V-72 is essentially the same DVM as the militarized instrument Cubic built for the Polaris program, where it is part of the calibration console for the inertial navigation system. Cubic now offers this model at a price to meet commercial re-

quirements. If you need a 1-mv, 4-digit DVM with automatic ranging and polarity, that meets or exceeds Specification MIL-E-16400, <http://www.cubic.com>. For additional information about the V-72, write to Dept. B-181 or get in touch with your nearest Cubic representative.

SPECIFICATIONS

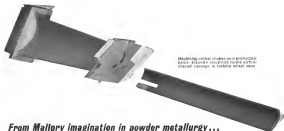
Absolute Accuracy: ±0.1% of reading, ±1 digit
Resolution: 1 mv
Reference Stability: 0.05% for 1 month, 0.15% 1 year
Bridge Linearity: 0.02%
Temperature Range:
 —Operating: —50°C to +125°C
 —Storage: —9°C to +55°C

Input Specs (Floating):
 F: 100 mv to 1000 v
 CNE AC: 30 ohm to 100 kΩ
 100-ohm to 50 kΩ
 DC: 100 ohm

Range & Polarity: 600 VDC to 999.9 VDC, completely automatic

Average Balance Time: 400 msec; worst case, 500 msec
Calibration Cycle: 6 months

Also meets MIL E 16400 Electronic Equipment, Naval Ship and Stores, General Specification



Machining critical features on a prototype brass. Elasto's electrode for the part's internal passage is turned about 90°.

From Mallory imagination in powder metallurgy... electrodes for precise machining of space-age metals

Electrical discharge machining is often the most practical way to form metals that are difficult to work by conventional techniques. It causes little thermal or mechanical stress, leaves no burrs, doesn't upset heat-treated structure of the base material.

For the difficult EDM jobs, there's nothing like Mallory Elasto's electrodes. They wear at only a fraction of the rate of usual electrode materials. Elasto produces highly accurate contours, sharp corners, permits cuts to extremely close tolerances with excellent surface finish.

For example, at Metcon Corporation, Hanover, N. J.—specialists in EDM of exotic metals—Elasto 10W8 is used for electrodes in a variety of production

EDM jobs. An aperture in a molybdenum wastegate is cut to tolerance of 0.0001". On a nitrided part, 85 roughing cuts were made with one electrode, and tolerances of ±.001" were held on the finish cut. A round part formed by rotating bar stock inside a split electrode was produced to tolerance of ±.0005". Turbopump nozzles for rocket needles are finish cut to an accuracy of ±.20 seconds in the tapered hole.

One of the many products of Mallory's pioneering in powder metallurgy, Elasto materials have proved the answer to space-age problems calling for refractory, conductive and abrasive materials. Write or call us for a consultation. Mallory Metallurgical Company, P. O. Box 1882, Indianapolis 6, Indiana.



Turbopump nozzle needs (right) tapered hole is machined in .150 seconds by using Mallory Elasto electrode.

MALLORY METALLURGICAL
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Refractory metals • High strength materials • Special alloys



First Series 200 Argosy Freighter in Advanced Construction

First Argosy Series 200 half-tonnage freighter (AV Sept. 8, p. 26) is in advanced stage of construction at Area Wharfway Div. of Boeing Fieldley Aviation. The aircraft of this series will be built on spotorders. The wings change from the Series 100 Series, now at press with Capital Airlines and British European Airways (a new wing with integral fuel tank). Maximum takeoff weight has been increased to 90,000 lb., compared with 85,000 lb. on the Series 200 plane.

aircraft, expensive navigation in previous construction, and various factors.

Martin Co.'s Nuclear Div., Bellevue, is developing an almost perfect underwater sound beacon as a navigational

aid for ships. Research will produce sound—a high pitched squeal—from the flow of oil driven by steam created from the heat of radioactivity. The beacon will not need electricity or chlorine compound and can be contained in a one cubic foot box.

Citilink Corp., Los Angeles, will build "Quadradar" ground-controlled approach radar landing systems for the West Coast in four under terms of contract totaling more than \$4 million. It was awarded by the West Coast government.



Lockheed C-141 Wing Shows Clean Design

Uncluttered lines of the wing on the Lockheed C-141 StarLifter jet transport (AV Sept. 8, p. 58) are evident on the overhead view. Fowler flaps, instead of ailerons, on the only high lift device. Speed brake, pusher, down aircraft, are put forward of the flaps. Engine pylons do not extend to the wingtip, leaving the leading edge unobstructed. Moderate 25-deg sweepback aids takeoff performance.



CHROMALOX ELECTRIC FLEXIBLE & WOLDED HEATERS
WRAP...CLAMP...BOND heat to any surface and shape.

Chromalox Chromalox Flexible and Welded Heaters can be shaped to heat any form. Easy to apply—they provide exact temperatures in all parts, at only one temperature. At an object. Available in a wide variety of voltages and amperages in temperatures up to 1000°F. Typical uses include heating elements, battery components, capacitors, controls, fuel systems, pressure devices and similar components requiring controlled heat. Write for Bulletin PM-100, 90-10.



CHROMALOX ELECTRIC HEATING UNITS
QUICK, LOW COST ANSWERS to your heating problems

Whether it's space, liquid or solid you want to heat to exact temperatures... you'll find the easy and economical answers to Chromalox Electric Heaters. Thousands of units to choose from (mostly from stock) in tubular, wallplug and shroud materials to meet working temperatures up to 1200°F... manual or automatic thermostat controls. Tell us your heating problem—our field engineers will come up with the answer.



CHROMALOX ELECTRIC Explosion-Proof COMFORT HEATERS
COMPLETELY SAFE HEAT in hazardous atmospheres

Now get the comfort heat you want even in hazardous areas. These new Chromalox electric heaters are designed to provide heat of warmth safely, economically without noise, gases, odors, vibrations and other harmful by-products. Heat sources in "Proof" are explosion resistant and do not develop hot spots, leaving clean, smooth, safe, clean, safe, clean, safe... can easily be changed to wall. Write for Bulletin PM 120.





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Albany, N.Y.	402 755-1400	Albuquerque, N.M.	505 261-0101	San Francisco, Calif.	415 398-0101

New Facility is Designed for Microcircuits

By Philip J. Kline

Elbridge, Md.—New \$5-million Westinghouse Molecular Electronics Division facility here, the first designed solely for development and production of semiconductor microcircuits, has the capacity for handling not more than a million units per year.

The 110,000-sq-ft facility will give Westinghouse the capacity to produce several times the total number of microcircuits expected to be manufactured by all suppliers during the current year.

For Westinghouse, a late starter in the semiconductor device business, the facility represents a major commitment of resources intended to establish the company as a top contender in the microcircuit field.

This view, as a result of an order to set up a West Coast microcircuit development and manufacturing facility which resulted from company's pioneering development and development work in "molecular electronics" under

Air Force sponsorship (AW Aug. 27, 1968, p. 54). Westinghouse's microcircuit sales will grow at a rate of five to ten percent annually, according to Harro Knevel, general manager of the Molecular Electronics Div. Within a year or two, as the Elbridge facility makes its impact felt, Knevel predicts that Westinghouse will become the top producer despite tough competition.

Lot of current major customers for Westinghouse microcircuits include Aerospace Instruments Laboratories, Hughes Aircraft, Martin Co., North American's Aerospace Div., National Cash Register Co., Raytheon and Sperry Rand's Unisys Div.

The present facility occupies only a small portion of the 10-acre site here and has been built using available construction to facilitate integrated construction. It is located on an area used from the Westinghouse Defense Center which houses company's Air Arms and Electronics Division. Present employment here is about 300, including en-

gineering, administrative and support personnel.

In contrast to many other companies in the microcircuit field, Westinghouse devoted about a year ago to continuing almost all of its microcircuit efforts within an entirely new division rather than develop the business in an adjunct to its semiconductor device operations.

Initially, the West Coast plant was transferred to the new Molecular Electronics Div. Within the past several months, research and engineering from the company's Central Research Laboratories in Pittsburgh and the Semiconductor Products Div. in Youngstown, Pa., have been transferred here. Except for basic research, which remains in the second laboratory, the only other microcircuit activities outside the Molecular Electronics Div. are those in the nearby Air Arms and Electronics Division. Those are primarily test development operations which are oriented toward specific airborne equipment needs of the division.



ENGINEERING AND TEST and development circuit functions are performed in this area of Westinghouse's new \$5-million semiconductor factory near Baltimore. Machines visible here are used to attach gold leads to semiconductor chips. Another section handles microcircuit design and development.

- The new facility here was designed to provide for three different types of microcircuit manufacturing operations:
- **Standard circuit functions** which involve large-scale repetitive processes.
- **Custom-designed circuits** in prototype quantities to permit rapid access to the responsive to special customer needs.
- **Engineering samples** for use by other personnel engaged in developing new circuit functions.

Each of the three types of manufacturing operations will be carried out in a separate module, with approximately 10,000 sq ft allocated for production processes within each module. (The manufacturing rate is used for design, test and support functions. Air conditioning, RF testing, air-cleaning and similar support operations is housed in a 45,000-sq-ft basement directly underneath the production area.)

The standard circuit and test-center production areas allow one another without separating personnel so that either can use the other's facilities if the work load is not evenly divided.

All three laboratories areas generally have been equipped with the identical machines and equipment. The objective is to minimize problems of moving a newly developed functional circuit from engineering into routine or standard production. Techniques developed in engineering laboratories and not be altered for large-scale production.

Knevel, who headed the semiconductor manufacturing business originally at Bell Telephone Laboratories and later worked for Motorola in its microcircuit and semiconductor operations, says there are important differences between the manufacturing of transistor and semiconductor microcircuits despite the superficial similarity in the process used.

In the semiconductor device business, a single chip contains only a single transistor or diode while a microcircuit chip contains many components, usually including transistors, diodes, resistors and capacitors. To achieve a semiconductor chip yield rates of gold wires to the test process can be possible to that obtained in making transistors requires much tighter control over each of the many steps in the fabrication process, Knevel points out.

Where the transistor manufacturer usually can find another market for devices which fail to meet some rigorous defense-specification tolerance, such as basic performance or commercial requirements, the microcircuit manufacturer usually must find a use for chips that fail to meet intended performance specifications.

This means that for more extreme and rigorous inspection and test procedures must be used in the manufacture of semiconductor microcircuits, Knevel says. Additionally, because



LARGE-SCALE standard circuit function are produced in this facility at Westinghouse's new 110,000-sq-ft facility at Elbridge, Md., near Baltimore. The facility contains all of the company's microcircuit efforts within an entirely new division.



FLAT-PACK microcircuit in microcircuit area located here. Knevel also points out. Components here have with glass added a hot spot on furnace (top right) where the glass here is low hermetic seal between ceramic and metal leads.

microcircuits are relatively easy to construct much denser than those that have more complex circuits than those normally required for standard transistor production.

Microcircuit fabrication also requires a higher caliber of human personnel than does transistor manufacturing, Knevel says. As with transistor fabrication, too, where firms the best of the best personnel. Many of the workers now employed here in microcircuit fabrication have several years of college training. They are selected for their aptitudes in the microcircuit field, automation applied to its, microcircuit fabrication process. Westinghouse believes that at this stage of the game the design and production of a skilled human operator in the fabrication process would

be difficult for a machine to match. The microcircuit, which are being produced here and on the West Coast are entirely of the semiconductor type, but their thin deposition methods are an early in the Molecular Electronics Div. look ahead to the possibilities of hybrid microcircuits using a combination of semiconductor and thin-film techniques.

The engineering department here is studying the types of thin-film materials being used by others and the positive and negative reported, prior to selecting the materials and techniques which will be investigated here. Present plans call for the use of electron beam evaporation. Machines are on order will permit testing of the work material up to five

1964

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WHO'S WHERE

(Continued from page 21)

Changes

C. Ross Corso, co-director of engineering, Motorola Electronics Corp., Palo Alto, Calif.

Robert W. Wooten, chief engineer, Eagle Systems Dept., Electronic Industries Assn., now offices in New York N.Y.

Dr. Stanley E. Kautz, head, Electronic Research Dept., Research Div., Melpac, Inc., Palo Alto, Calif.

Jack E. Mullen, assistant program manager, Apollo Earth landing system, Northrop-Vought Services, Fort, Calif.

David Rykles, manager control and post test planning, Motorola's Chicago (Ill.) Micro Electronics Center, succeeding Robert H. Ballman (AW Aug. 19 p. 111).

Also RIT Staffed: chief executive, electronics, Motorola Electronics Center.

More R. I. tech. personnel for the Sciences and Advanced Sciences Division of Aeronautics Corp. at Wallingford, Conn.

Robert K. Belling, director of marketing planning, LFK Electronics, a division of Laboratory For Electronics, Inc., Boston.

John H. Green, Jr., director of advanced programs, Aeromarine Div. of Peoria Corp., Newport Beach, Calif., a subsidiary of Ford Motor Co.

Capt. William Dulek (USN ret.) director of manufacturing, Aero Corp.'s Civil Aeronautics Div., Richmond, Ind.

Joseph W. Anderson, director of systems, McDonnell Aircraft Corp., St. Louis Mo., replacing Ross John Lloyd Harrison (USN ret.) serving at two product development and quality assurance.

James J. Cooke, head, "The Micro Corp." in frequency business Dept., Redford Mass.

Geoffrey R. Koffel, project manager for advanced design systems, California Inst. of Technology, Los Angeles, California.

John J. Wooten, chief engineer, Aero Corp., St. Louis Mo., replacing Ross John Lloyd Harrison (USN ret.) serving at two product development and quality assurance.

William P. Anderson, director of space information systems, Aerospace Div. of General Dynamics, Inc.'s Information Systems Group, San Marcos, Calif.

Dr. Robert A. Koffel, program director, Los Angeles-based Navigation System Inc., succeeding a chief for advanced electronic systems, Aero Corp., St. Louis Mo.

Dr. John S. Nordin, chief engineer, Aero Corp., St. Louis Mo., replacing Ross John Lloyd Harrison (USN ret.) serving at two product development and quality assurance.

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LETTERS

Local Subsidies

I would like to comment on Mr. Gold's article (AWE Aug. 13 p. 34) on local airlines.

CAR's view toward the local airline and subsidy is misleading in many cases as is shown in the article on subsidy allocations. From subsidies should be reduced as traffic and profits increase, but not at the expense of the public where the airlines should provide with efficient expanded service.

Lately CAR is encouraging the airlines' move to place more money toward its sub-sidized markets and at the same time it is joining the DOT in the most economical equipment for the local. I am afraid the local airports, with new equipment, are placed public, airport and companies are from increasing traffic and convenience. The assistance of the DOT cannot be depicted, but not I point out that in 1962, when the bulk of the operating profits were made by local carriers without DOT's equipment, not mentioning that most profits with the aid of the local carriers were generated. Moreover, Convair and Fairchild, which also had high local factors DOT had factors are dropping in recent years. The article claims that local growth rate is around 4% annually. Here is the possible slow but no percentage increase growing 22.9% with total revenue going up 30-45%. Does that tell the story a relative drop of subsidies against economic growth?

CAR's conclusion of subsidy by noting service into small cities better than it was many of the air to line of cities were added as most cities to be dropped upon, showing CAR's inability to adjust service properly and control its constantly dropping rates. CAR is questioning the purpose of the subsidy as a virtue, which is to provide service into smaller cities for the public assistance and is an aid to the regional economy. That leaves from traffic either can be reduced not from profits of more routes, more of which are not increasing adequate air service. Public complaint has been rising all over the nation for missing routes between cities such as Los Angeles and Chicago as well as between Los Angeles and San Francisco and West Coast. Complaint is increasing as a result of environment in service, it is not primarily a lack of subsidies. In the future, increased DOT generosity as better subsidies, without hurting the public who are the best solution to safety and not a better local airline subsidy.

Steve P. Donovan
Los Angeles, Calif.

More on Sightings

Random Strangers and Strife (AWE Aug. 12, p. 118) has suggested that Mrs. Cooper is able to discern what objects are at great distances may have wanted her being and manipulation by the atmosphere. I had previously considered this possibility and compared the material of the first part of the ground exposure of anomalous objects. Unfortunately the effect is negligible for astronomical propagation through the atmosphere.

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to have letters under 500 words and give a complete identification. We will not print anonymous letters, but names of writers will be withheld on request.

There the atmosphere simply obscures one or two hundred feet of altitude above them into the "imagined" object. Atmospheric turbulence probably causes more or less frequent factors affecting observations through the atmosphere. The "bending" of stars may be attributed to this cause. Turbulent "refractive" properties may deflect as surface variations so that other the apparent location of an object may be displaced from its true location, as the object may occur in the foreground. Most importantly, the effect is much less (in 1950) for an astronaut looking at the ground than for a ground-based observer looking out. The effect is effectively, because the refracting index acts as the fulcrum of a lens with a very short focal arm on the earth-bound observer's end and a very long focal arm on the astronaut's end.

Reader Smith's "angle" was a rather subtle demonstration of the proper cause, namely the effect is effects, angle objects out to nearly the object.

WALTER HOBBS
Burlington, Ohio

European View

Mr. Hollings and I who are concerned with the role of materials research for the development of aircraft and space have been more than a little intrigued by the two notes contained in your issue of July 29, pp. 64 and 28 respectively.

In the former, the author expresses the belief of U.S. industry a common request that European countries could be getting used to making themselves self-sufficient in raw materials and products which they have previously purchased almost in total with U.S. funds, but nevertheless at considerable expense from America. In our case, at least at present stage but, considerable political pressure has been brought to bear to ensure that materials readily available in Europe to aircraft manufacturers, are sold, after some 25 years have passed from American sources at a price which is not as much as 10% and less than the European situation. This we must obviously expect although we would have preferred to have kept this to a fairly commercial situation without any political pressure. What does state of Europe, in my view is the other article in which Europe is reported by the American industry that the European industry is and may be in the same position in America. Your paragraph giving the reasons of officials from the Long Beach Division of Commerce pointing out that the French to produce their own aircraft on the U.S. economy seems to us to be rather ludicrous.

By all means let us have good business

relations in Europe and America, but please don't spend when Europe manufacturers do us by and long political relations out of it. We are just not used to it over here.

F. A. MONTAG
Hartford, England

Titov Launch

In our July 22 issue on page 107 and 112, the author dealing with Soviet manned space flight, says nothing that is all. Cal Clouston. There was launched on Aug. 6, 1962. Should not the last issue Aug. 6, 1962?

Congratulations on another fine special issue.

DAVID F. SCULLY
Grand Forks, N. D.

(Reader Scully has a good eye for dates. —Ed.)

Back-Pack

The related photograph covering "Manned Space Flight" (AWE July 22, p. 107) is accurately captioned and surprisingly relevant.

The back-pack worn by the astronaut in this photo is not a life support pack but a backpack equipment unit. Specifically, the unit shown is the Experimental Aircraft Manufacturing Unit fabricated by the Clinton Naught Corp. for the Astronaut System. The Air Force personnel have been testing this unit as the KC-135 into G aircraft for the past 12 months. During this test program the NASA astronauts were given the opportunity to fly the A-10. They did, with considerable success. This first flight is the first.

This effort has been the primary in research and development on individual payload man. We currently have the only backpack that operates successfully in the weightless environment. Although the pack cannot sustain "man" several years ago, it was now becoming comfortable to wear by the time the Air Force and NASA had testing on the Gemini spacecraft so that man can cut the vehicle and do important extra-vehicular tasks.

Articles need to stop making incorrect deductions and should give credit to the people who are responsible for the work.

JOHN N. VAN BUREN, P. E.
AEDU Project Engineer
Aero Propulsion Laboratory
AED, WPAFB

Northrop T-38

May I call your attention to an error in your issue of July 22 (p. 219) when you refer to "New North American F-105." I can only state that the T-38 trainer is manufactured by the Northrop Corp., North Dear, Hawthorne, Calif.

THOMAS W. PANK
Berkeley, Calif.

(Northrop is correct.—Ed.)



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